

LeCroy

PROTOCOL SOLUTIONS GROUP
3385 SCOTT BLVD
SANTA CLARA, CA 95054

PETracer EML™ PCI Express Multi-Lane Protocol Analyzer

PETrainer EML™ PCI Express Multi-Lane Exerciser

User Manual



For Software Version 5.7x

August 2009

Document Disclaimer

The information in this document has been carefully checked and is believed to be reliable. However, no responsibility can be assumed for inaccuracies that may not have been detected.

LeCroy reserves the right to revise the information in this document without notice or penalty.

Trademarks and Servicemarks

LeCroy, CATC Trace, PCI Express, PETracer Edge, PETracer EML, PETracer ML, PETracer, PETrainer EML, PETrainer ML, PETracer Summit, Summit T2-16, Summit Z2-16, Universal Protocol Analyzer System, UPAS, and BusEngine are trademarks of LeCroy.

Microsoft and *Windows* are registered trademarks of Microsoft Inc.

All other trademarks are property of their respective companies.

Copyright

Copyright © 2009, LeCroy Corporation. All Rights Reserved.

This document may be printed and reproduced without additional permission, but all copies should contain this copyright notice.

WEEE Program



This electronic product is subject to disposal and recycling regulations that vary by country and region. Many countries prohibit the disposal of waste electronic equipment in standard waste receptacles. For more information about proper disposal and recycling of your LeCroy product, please visit www.lecroy.com/recycle.

TABLE OF CONTENTS

Section 1. General	1
Chapter 1 Overview	3
1.1 PETracer Analyzer Hardware and Software	3
1.2 PETrainer Exerciser Hardware	5
1.3 CATC Trace Software	6
1.4 PETracer EML Analyzer	7
1.5 PETrainer EML Exerciser	9
1.6 Other Documents	10
Chapter 2 Hardware Description	11
2.1 System Components	11
2.2 Host PC Requirements	12
2.3 Universal Protocol Analyzer System (UPAS)	12
2.4 Protocol Analyzer Modules	13
2.5 PETrainer Exerciser	14
2.6 PETracer EML Analyzer LED Descriptions	15
2.7 PETrainer EML Exerciser LED Descriptions	16
2.8 Rear Panel Description	18
2.9 Specifications for PETracer EML/PETrainer EML	20
2.10 External Interface Breakout Board	23
Pin-Outs for the Data In/Out Connector	24
Prototype Rework Area	24
Breakout Board Input and Output Signals	25
Chapter 3 Installation	27
3.1 Installing the PETracer Software	27
3.2 Setting Up a PETracer Analyzer	29
3.3 Setting Up a PETrainer Exerciser	30
3.4 Networking an Analyzer	31
Setup for IP LAN Use	31
3.5 Browsing to a Networked Analyzer	32
3.6 Connecting the PETracer EML Analyzer to the Device Under Test	33
3.7 Connecting PETrainer EML to the Device Under Test	35

Section 2. PETracer Analyzer Software . . . 41

Chapter 4 Software Overview 43

4.1 The PETracer Software	43
4.2 Application Layout	44
4.3 Using the Toolbar	45
Multi-Segment Toolbar	47
Traffic Generation Toolbar	48
Toolbar Hide Buttons	49
4.4 Using the Menus	51
4.5 Tool Tips	57
4.6 Keyboard Shortcuts	57
4.7 Status Bar	58
4.8 Making a PCI Express Recording	61
4.9 Recording Multi-Segmented CATC Traces	63
How to Create a Multisegment Recording	63
4.10 PETracer Files	65
CATC Trace Files	65
Recording Options Files	65
Display Options Files	65
4.11 Opening CATC Trace Files	66
4.12 Saving CATC Trace Files	67
Using the Save As Function	67
Saving a Portion of a CATC Trace	67
4.13 Exporting a CATC Trace File	68
4.14 Printing Data Files	69
4.15 Analyzer Chat Window	70

Chapter 5 Reading CATC Traces 71

5.1 Viewing PCI Express CATC Traces	71
5.2 Expand and Collapse Data Fields	71
5.3 Resizing Cells	71
5.4 Pop-up Menus	72
5.5 View Data Block	72
5.6 Show Raw 10b Codes	73
5.7 Show Header Fields	74
5.8 Packet Cell Popup Menus	75
Packet Header R-> Cell Popup Menu	75
Packet Header G1 Cell Popup Menu	76
5.9 Set Marker	77
5.10 Edit or Clear Marker	78
5.11 Decoding Traffic	79
Packet	79
Link	79
Split	79

Chapter 6 Searching CATC Traces	81
6.1 CATC Trace Search Overview	81
6.2 Go to Trigger	81
6.3 Go to Packet	81
6.4 Go to Time	82
6.5 Go To Marker	82
6.6 Go To Menu	83
6.7 Search Direction	84
6.8 Find	85
Event Groups	87
6.9 Search for the Next Packet Type	87
Chapter 7 Display Options	89
7.1 Setting Display Options	89
7.2 Specifying General Display Options	90
Analysis Tools Checkboxes	90
Fonts	90
Configuration Name	91
7.3 Color, Format, and Hiding Options	91
Setting Field Colors	92
Changing Field Formats	94
7.4 Load a Previously Saved Display Options File	98
7.5 Saving Display Options	98
Chapter 8 Recording Options	99
8.1 Setting Recording Options	99
8.2 General Tab	100
Recording Type	102
Buffer Size	102
Target Analyzer	103
Trigger Position	103
Trigger On	103
Trace Filename and Path	103
Options Name	104
Save As MultiSegment Trace	105
Viewing Multisegmented Files	105
Misc	106
Link for PETrainer EML	107
Saving and Loading Previously Saved Recording Options	109
Setting Default Recording Options	109
8.3 Recording Rules Overview	110
Global State vs. Sequences	111
8.4 Recording Rules Buttons	112
8.5 Creating Recording Rules	112
8.6 Recording Rule Limits	115
Configuration Limitations in PETracer EML	115
8.7 Recording Rules Logic: How Contradictory Rules are Resolved	116
Recording Rules Examples	116
8.8 Properties Dialog Boxes	123

8.9 Event Properties Dialog	124
Accessing the Properties Dialog	124
Dialog Settings and Features	124
Error Properties Dialog	125
Actions Properties Dialog	125
TLP Header Properties Dialog	126
TLP Prefix Properties Dialog	126
Payload Properties Dialog	127
DLLP Packet Properties Dialog	127
Ordered Set Properties Dialog	128
8.10 Counting Events	128
8.11 Creating a Payload Match	130
8.12 Trigger	132
8.13 Filter In and Filter Out	133
Chapter 9 Reports and Tools	135
9.1 File Information	136
9.2 Error Summary	137
9.3 Traffic Summary	138
Using the Traffic Summary Window to Search the CATC Trace	138
Traffic Summary Buttons	139
9.4 Bus Utilization	140
Bus Utilization Pop-up Menu	141
Bus Utilization Buttons	143
9.5 Link Tracker	145
Using the Link Tracker Window	146
Link Tracker Buttons	149
9.6 Data Flow Window	151
9.7 Using the Trace Navigator	152
Displaying the Navigator	152
Navigator Toolbar	153
Navigator Ranges	153
Navigator Panes	155
9.8 LTSSM Flow Graph	158
9.9 Packet Header Bar	159
9.10 Packet Data Window	160
9.11 Configuration Space View	161
9.12 Using Unit Metrics	163
Show Metrics in the CATC Trace Display	164
Show Metrics in the Traffic Summary Window	166
Show Metrics in the Bus Utilization Window	168
9.13 Real-Time Statistics Window	171
Real-Time Statistics Buttons	172
Real-Time Statistical Monitor Pop-up Menu	174
Real-Time Statistics Graph Areas	175
9.14 TC to VC Mapping	177
9.15 Timing and Bus Usage Calculations	178
9.16 Running Verification Scripts	180

Section 3. PETrainer Exerciser Traffic Generation 183

Chapter 10 Traffic Generation 185

10.1 Theory of Operation	185
10.1 Traffic Generation Files	187
10.2 Creating a Traffic Generation File	189
Exporting a CATC Trace to a Traffic Generation File	189
Saving a PETrainer Script to a New File	190
Creating a New Empty Generation File	191
10.3 Editing Generation Files with the Script Editor	192
Script Editor Toolbar	193
Script Edit Window	194
Command Properties Window	196
Script Editor File Tabs	197
Script Editor Error Log	197
View Options Menu	198
10.4 Generation Options Dialogs Overview	198
Opening the Dialog	198
10.5 Generation Options for PETrainer EML	199
General	199
Link	201
Integrity	202
Flow Control	204
Transactions	206
10.6 Generating Traffic: Set Generation Options	208
10.7 Generating Traffic: Prepare Traffic Generation	209
10.8 Generating Traffic: Begin Traffic Generation	210

Chapter 11 Macros 213

11.1 Macros	213
Default Macros: Connect and Disconnect	213
11.2 Adding New Script Macros	214
Using the Generation Macros Dialog	214
Adding Script Files to the GenScriptMacros Directory	215
11.3 Modifying Script Macros	216
11.4 Changing the Order of Macro Icons on the Status Bar	216
11.5 Deleting User-Defined Script Macros	217
11.6 Restoring the Default Appearance of the Connect and Disconnect Icons	217

Chapter 12 Address Space 219

12.1 Address Space Toolbar Buttons and Dialogs	219
Write Address Space Button	220
Read Address Space Button	221
12.2 Memory/IO Space Editor	223

Chapter 13 Configuration Space	225
13.1 Configuration Space Editor	225
13.2 Launching the Configuration Space Editor	225
Configuration Space Files	225
Editing	226
13.3 BARs Setup	229
13.4 Configuration Read and Write	230
Chapter 14 Updates and Licensing	231
14.1 Updating the Analyzer	231
14.2 License Keys	232
14.3 License Information	232
Appendix A Configuration Space Decoding	233
A.1 Mandatory Definitions	233
A.2 Mandatory Module Functions	233
A.3 Configuration Register Types	234
A.4 Primitives	234
A.5 Helper File	235
Appendix B China Restriction of Hazardous Substances Table	236
How to Contact LeCroy	239
Index	241

Section 1. General

Chapter 1: Overview

Designed for developers and validators, the LeCroy PETracer/Trainer EML™ is a PCI Express 16-lane advanced verification system.

By leveraging years of experience in protocol analysis tools for emerging markets, PETracer/Trainer EML blends sophisticated functionality with practical features to speed the development of PCI Express™ IP cores, semiconductors, bridges, switches, add-in boards, and systems.

1.1 PETracer Analyzer Hardware and Software

Features and Benefits

PETracer EML Analyzers have these features and benefits:

Features	Benefits
Powerful and Intuitive CATC Trace™ Analysis Software	Faster interpretation and debug of PCI Express traffic with color-coded, clearly labeled protocol elements in a graphical display. Reduces coding and deciphering.
Extensive Decoding	Complete, accurate and reliable decoding of TLPs (Transaction Layer Packets), DLLPs (Data Link Layer Packets), and all PCI Express Primitives
Monitoring and Link Utilization	View link utilization and other performance measurements changing in real time. Save this data to view as post-session statistics.
Advanced Triggering	Isolate important traffic, specific errors, or data patterns. Trigger condition setup is made simple with drag and drop tools to link events to trigger or filter actions.
Hardware Filtering	Analyze faster and understand transactions more clearly by removing non-essential fields from the CATC Trace.
Intelligent Reporting	Quickly identify and track error rates and abnormal link or timing conditions. Display configuration space and protocol specification details.
Sophisticated Viewing	View Packet, Link and Split Transaction levels of the PCI Express protocol. Collapsible/expandable headers with Tool tip explanations make it easy to navigate and interpret packet contents, headers, and commands. View packets, transactions of TLPs and DLLPs in classic CATC Trace™ format or in raw 10b code for deeper analysis.

8 GB Recording Capacity	Capture long recording sessions for analysis and problem solving
Hi-Speed USB Port	Access PCI Express recordings up to 40x faster than USB 1.1. No complicated setup required.
Downloadable Trace Viewer	Share and annotate CATC Trace recordings within a development team. Freely distributable PETracer software enables collaborative analysis across sites and time zones.
Taps non-intrusively into a single x1, 2.5 gigabit/second PCI Express port using MicroGigaCN receptacle and one standard x4 cable	Accurate and non-intrusive collection of PCI Express CATC Trace data
Field-upgradeable firmware and recording engine	Upgrades available for download direct from LeCroy website
Flexible probing options	Active and passive slot interposers MidBus probe Flying lead probe Gen1 AMC interposer Gen1 XMC interposer Gen1 SIOM interposer Gen1 Express card interposer
External interface for probing and monitoring auxiliary digital signals	Enables cross triggering between other test instruments.
Dword to Transaction Level Viewer	View Dwords, Packet, Link and Split Transaction levels of the PCI Express protocol.
CRC checking	Know that info being displayed is accurate.

1.2 PETrainer Exerciser Hardware

Features and Benefits

PETrainer EML Exercisers have these features and benefits

Features	Benefits
Script level traffic generation	Programmability to test PCI Express components with more precision and control
Convert CATC Trace files into generation scripts	Recreate failure scenarios by replaying recorded traffic
Manual Error injection	Verify fault handling and identify error recovery
Host/End-Point Emulation Support	Host emulation platform/end-point emulation Interposer allows for design and stress testing.
Programmable Physical Layer	Flexibility to program lane skews, link control bits, skip intervals and link states for more robust verification
Programmable Data Link Layer	Ability to modify flow control, ACK/NAK, and retry behaviors
Flexible/programmable Transaction Layer	User ability to define arbitrary sequence of transactions, payload generation, and conditional repeat of transactions provide users with maximum flexibility
Raw Generation mode	Allows complete control of each symbol transmitted
Programmable reply timers	Allows testing of ACK latency timeouts and retry mechanisms
Point and Click Script Editor	Complex scripts can be created quickly and easily
Error Insertion	CRC Errors Running Disparity Errors Insertion of Invalid 10-bit symbols Lane to Lane Skew Insertion Lane Reversal Polarity Inversion

Programmable ACK/NAK behavior	ACK all TLP packets NAK all TLP packets Automatic ACK/NAK behavior ACK/NAK delay timer
Programmable Flow control behavior	Set Credit values Disable Credit checking Set Update InitFC intervals
Automatic CRC calculation and Sequence number assignment	DLLP CRC calculation TLP LCRC calculation
Replay buffer	Programmable Transaction timeout timer Auto Recovery behavior after 4 Replays
Programmable configuration space	Full 4 KB configuration space configurable by user Accessible through Configuration Reads and Writes over PCI Express
Programmable address spaces (PETracer EML only)	
Automatic transaction completer (PETracer EML only)	

1.3 CATC Trace Software

PETracer EML utilizes the CATC Trace™ to assist users in analyzing how PCI Express components work together, diagnose problems, and test for interoperability and standards compliance.

The CATC Trace is a powerful and intuitive expert software system embedding detailed knowledge of the protocol hierarchy and intricacies, as defined in the protocol specification. The software allows the user to control the Analyzer and set specific real-time triggering and filtering conditions. The CATC Trace utilizes a Windows-based graphical display that has been optimized for fast and easy navigation through a captured traffic session. Users are alerted as violations are detected at all levels of the protocol layering and can easily drill down on areas of interest or collapse and hide fields that are not relevant.

1.4 PETracer EML Analyzer

The PETracer EML allows semiconductor, motherboard and add-in card manufacturers to capture, analyze and view PCI Express traffic.



There are two ways to connect the PETracer EML to the point-to-point PCI Express bus, using either a card-edge slot Interposer card or a mid-bus probe (for more information about mid-bus probes, refer to the *PETracer Mid-Bus Probe™ Installation Guide*). PCI Express traffic can then be non-intrusively recorded. Live data is sent from the PETracer EML to a PC in order to display real-time statistics. Sophisticated trigger options are used to capture and buffer only data of interest. Real-time hardware filters in the system filter out unwanted traffic in order to maximize memory buffer utilization. Captured data is uploaded to the PC for further processing and displayed by the powerful CATC Trace™ software.

PETracer EML provides accurate, reliable and complete decodes of Transaction Layer Packets (TLPs), Data Link Layer Packets (DLLPs), and all PCI Express ordered sets. The buffer size has been increased in the PETracer EML to 4GB per direction. PCI Express Specification 1.1, 1.0a, and 1.0 are supported at the full-speed of 2.5GHz per lane. Automatic disparity checking, lane deskewing and data descrambling are all supported. The FPGA based design is fully field upgradeable. The PETracer EML can be controlled remotely via the user's LAN.

Sophisticated controls allow the user to decide what is captured and how it is viewed in order to analyze design problems and perform root cause analysis. Powerful triggering conditions allow the user to trigger on Error, Link, TLP, DLLP or any user-defined data pattern in the traffic. Each type of trigger condition can be cascaded to create complex multi-layer triggers. Trigger points can be set to any location within the buffer to allow the user to capture data before and after the trigger. Full-featured filtering capabilities allow engineers to isolate areas of interest. Captured packets can be expanded or collapsed. Columns are user configurable to allow hiding fields that are not relevant. Powerful search capabilities further enhance the user's abilities to solve engineering and production problems.

The PETracer EML includes a powerful expert system that incorporates detailed knowledge of the hierarchy and intricacies of the PCI Express protocol specification to create multiple graphical views of PCI Express data. These Windows®-based color-coded graphical views have been optimized for fast and easy navigation through a captured traffic session. Each packet is decoded to display packet direction, sequence number, timestamp, packet type and other packet specific fields. Errors are detected at all levels of the protocol hierarchy and color highlighted for the user. Error conditions include: DLLP CRC, LCRC, ECRC, delimiter, disparity and symbol errors. Real-time statistics and post processing traffic summaries give the big picture of the data captured. Statistics can be viewed in tabular form or viewed in graphical form. Traffic summary views are hyperlinked back to data traces to quickly jump to the source of bugs.

The PCI Express protocol data can be viewed in several different hierarchical views. Data can be displayed at the physical layer with Link Tracker to display either 10B/8B codes, Symbols or hex in either raw or scrambled formats. Traffic can also be displayed at the packet or Link layer or in the application layer (split view). Placing the mouse pointer over packet data causes a tooltip with an explanation of the field. Tooltips explain annotations and often display substantial additional information about selected fields.

The PETracer EML is the first add-in module to utilize LeCroy's most advanced Universal Protocol Analysis System (UPAS), the UPAS 100K platform. The expanded memory buffer of 4GB per direction allows the user to capture deeper traces over a longer time period. The platform also provides scalability for the future with expanded hardware capabilities and the capacity for two independent plug-in modules in the same chassis. The UPAS 100K was specifically designed to support high-speed serial protocols like PCI Express.

PETracer EML has full x16 lane analysis capabilities as well as many innovative triggering and filtering options that allows the user to easily diagnose problems and test for interoperability and standards compliance in order to quickly create marketable PCI Express products.

1.5 PETrainer EML Exerciser

LeCroy PETrainer™ EML™, a PCI Express 16-lane advanced Exerciser system, is a critical test and verification tool intended to assist engineers in improving the reliability of their systems. It can emulate PCI Express root complexes or device endpoints. Built upon LeCroy's most advanced Universal Protocol Analysis System (UPAS) platform, the UPAS 100k, PETrainer EML is LeCroy's second generation PCI Express Exerciser. By leveraging years of experience in protocol analysis tools for emerging markets, the PETrainer EML blends sophisticated functionality with intuitive controls to speed the development and testing of PCI Express IP cores, semiconductors, bridges, switches and systems.



The PETrainer EML is a stand-alone PCI Express Exerciser that can generate and respond to all types of PCI Express transactions. The scripting language allows creation of Transaction Layer Packets (TLPs), Data Link Layer Packets (DLLPs) and Ordered Sets. ACK's and NAK's can be automatically generated under user control. Any packet field not explicitly specified is created automatically. For example, CRC's can be automatically calculated. Configuration ROM space can be emulated for any device including endpoints, bridges and switches.

A Configuration Space can be easily created by exporting a Configuration Space file created by the PETracer.

The scripting language is powerful yet easy to use. One way to create test scripts is to export traffic from a CATC Trace file captured with a LeCroy PETracer. You can modify the exported script to generate different test cases, insert errors, or create loop tests. The "point and click" capability of the script editor simplifies modifying or creating scripts. The scripting language allows for a link training script to be created with just three simple commands. Macro's can also be created for frequently used sequences.

1.6 Other Documents

For more information about PETracer and PETrainer, refer to the following documents:

- *LeCroy Analyzers File-based Decoding Manual*
- *PETracer/Trainer Automation Manual*
- *PETracer VSE Manual*
- *PETracer Gen2 Multi Lead Probe User Manual*
- *PETrainer Scripting Language Reference Manual*
- PETracer Online Help

Chapter 2: Hardware Description

The PCI Express™ system features the Universal Protocol Analyzer System™ (UPAS™), PETracer™ Analyzers, and PETrainer™ Exercisers.

2.1 System Components

- **PETracer EML system (based on the UPAS 100K platform):**
 - Two factory-installed PETracer EML™ Analyzer module(s)
 - One USB cable
 - Two probe data cables
 - Breakout Board with cable
 - x16 to x1 Edge Adapter
 - x16 to x4 Edge Adapter
 - x16 to x8 Edge Adapter
 - PETracer Software program CD-ROM
 - PCI Express Slot Interposer probe
- **PETrainer EML system (based on the UPAS 100K platform):**
 - Two factory-installed PETrainer EML™ Exerciser modules
 - One USB cable
 - Two probe data cables
 - Breakout Board with cable
 - x16 to x1 Edge Adapter
 - x16 to x4 Edge Adapter
 - x16 to x8 Edge Adapter
 - PETracer Software program CD-ROM
 - Device Emulator Card or Host Emulation Test Fixture

2.2 Host PC Requirements

PETracer EML and PETrainer EML connect to a Host PC. Please consult the **readme** file on the installation CD for the latest PC requirements.

2.3 Universal Protocol Analyzer System (UPAS)

The Universal Protocol Analyzer System (UPAS) is a base unit for LeCroy protocol Analyzer modules. The UPAS contains the recording memory and other resources used by all LeCroy Analyzer modules. At the back of the UPAS is a hi-speed USB port for transferring CATC Trace data to a PC.

- **UPAS 100K:** The newest and fastest of the LeCroy base systems. This unit supports the PETracer EML™.



2.4 Protocol Analyzer Modules

PETracer EML is a hardware module that plugs into LeCroy's Universal Protocol Analyzer System (UPAS).

- **PETracer EML:** x16 version of PETracer. PETracer EML works with the UPAS 100K.



Analyzer modules use hardware triggering to capture real-time events and hardware filtering to exclude unwanted data. Data is recorded into the Analyzer's buffer and then transferred over a USB line to a PC for display and analysis. Search and display capabilities in the Analyzer software allow you to quickly locate specific data, errors and other desired conditions.

An external DB-44 connector provides a path for externally supplied data or timing information to be recorded along with link traffic.

2.5 PETrainer Exerciser

PETrainer™ is a Multi-lane PCI Express Exerciser designed to assist engineers in improving reliability of their solutions and providing advanced capabilities for stress and compliance testing.

- PETrainer EML™: 16-lane system



All PETrainer models operate as standalone Exercisers capable of generating and responding to all types of PCI Express transactions. Both Exercisers also have the ability to create protocol variations and anomalies. Users may also create corner case and stress test scenarios to evaluate the robustness of their solutions. By utilizing the PETrainer error injection feature, engineers can create worst-case PCI Express traffic scenarios allowing them to validate the error handling capabilities of their solutions.

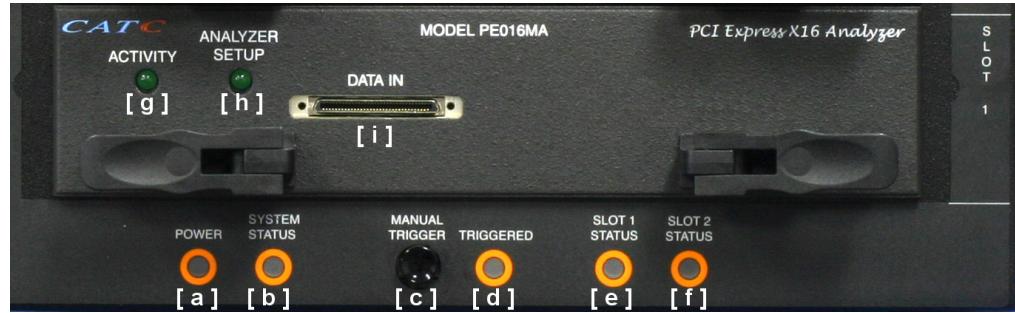
When PETrainer is used in conjunction with a PETracer Analyzer, a complete expert test and analysis system is created. This integrated solution delivers traffic generation and expert protocol analysis to assist developers with early validation of designs along with error injection and stress testing in preparation for compliance testing.

2.6 PETracer EML Analyzer LED Descriptions

When powered on, the PETracer EML activates the user-accessible controls and LEDs on the front and rear panels of the UPAS.

Warning! Do not open the UPAS enclosure. There are no operator serviceable parts inside. Refer servicing to LeCroy.

UPAS LEDs (from left to right)



- (a) **Power** indicator LED for UPAS: Lights when the unit power is switched on.
- (b) **System Status** indicator LED for UPAS: Lights during initialization/power up of UPAS base unit. Blinks if a self-test fails.
- (c) **Manual Trigger** push-button: Forces a CATC Trace trigger.
- (d) **Triggered LED**: Lights when the unit triggers on an event.
- (e) **Slot 1 Status**: Illuminates when the Analyzer in Slot 1 is recording
- (f) **Slot 2 Status**: Illuminates when the Analyzer in Slot 2 is recording

PETracer EML Module

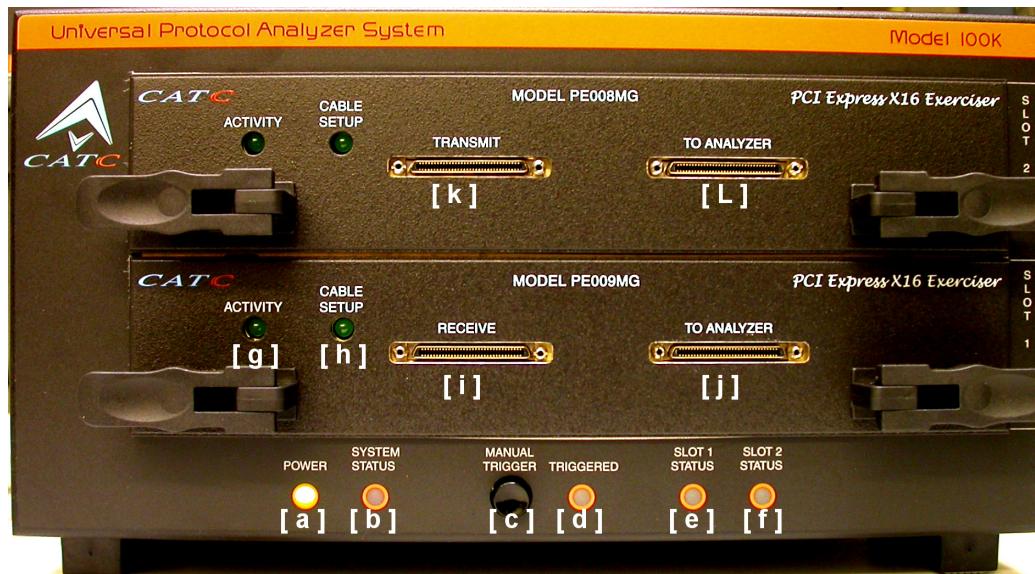
- (g) **Activity LED**: Illuminates when there is traffic on the link.
- (h) **Analyzer Setup LED**: Illuminates when cable is correctly connected between front of Analyzer and Interposer.
- (i) **Probe Data Connector**

2.7 PETrainer EML Exerciser LED Descriptions

When powered on, the PETrainer EML activates the user-accessible controls and LEDs on the front and rear panels of the UPAS.

Warning! Do not open the UPAS enclosure. There are no operator serviceable parts inside. Refer servicing to LeCroy.

UPAS LEDs (from left to right)



- (a) **Power** indicator LED for UPAS: Lights when the unit power is switched on.
- (b) **System Status** indicator LED for UPAS: Lights during initialization/power up of UPAS base unit. Blinks if a self-test fails.
- (c) **Manual Trigger** push-button: Disabled. On PETracer EML, this button forces an event trigger.
- (d) **Triggered** LED: Disabled. On PETracer EML, this LED lights when the Analyzer triggers on an event.
- (e) **Slot 1 Status**: Disabled. On PETracer EML, this LED illuminates when the Analyzer in Slot 1 is recording.
- (f) **Slot 2 Status**: Disabled. On PETracer EML, this LED illuminates when the Analyzer in Slot 2 is recording.

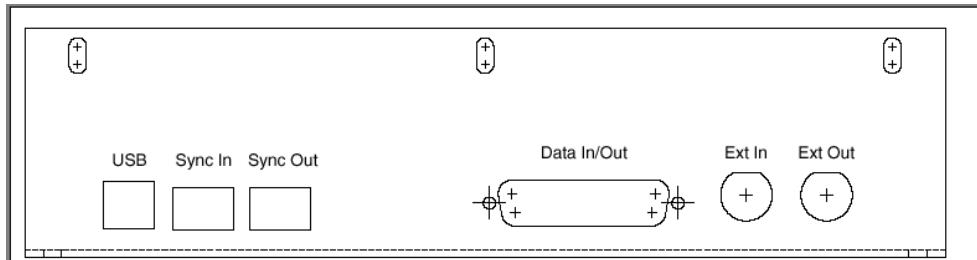
PETrainer EML Modules

- (g) **Activity LED:** On the **Transmit** module, this LED illuminates when linkup is established between the Exerciser and the DUT. On the **Receive** module, this LED illuminates when there is traffic on the link.
- (h) **Cable Setup LED:** On the **Transmit** module, this LED illuminates when an connection is established between the Exerciser and host emulator or device emulator.
- (i) **Receive Probe Data Connector:** Receives traffic from DUT.
- (j) **To Analyzer:** Transmits generated traffic from Exerciser to the **Receive** channel on a PETracer EML Analyzer. This is an optional connection for users adding a PETracer EML Analyzer to their setup.
- (k) **Transmit Probe Data Connector:** Sends generated traffic from Exerciser to DUT.
- (l) **To Analyzer:** Sends traffic received from DUT on the **Transmit** channel on a PETracer EML Analyzer. This is an optional connection for users adding a PETracer EML Analyzer to their setup.

2.8 Rear Panel Description

From left to right, the UPAS rear panel contains the following components:

Figure 2.1 PETracer EML Rear Panel



USB Type B Host Computer Connector

This connector links the Analyzer to the Host PC for the purpose of transmitting commands from the PC to the Analyzer and uploading CATC Traces from the Analyzer's recording memory to the *PETracer* software for viewing and analysis or links the *PETrainer* Exerciser to the Host PC for the purpose of downloading scripts and controlling the behavior of the Exerciser.

SFP Sync In and Sync Out Connectors

These connectors allow multiple UPAS 100K chassis to send synchronization and control messages to one another.

RS-232 40-pin Data Input/Output Connector

This connector links a 40 pin RS-232 cable to an external Breakout Board. The Breakout Board allows signals to be sent from the Analyzer to an external device such as an oscilloscope or from an external device to the Analyzer for the purpose of triggering on an external input. You configure input/output signalling through the Recording Options dialog box. Breakout Board use is described at the end of this chapter. This connector is not used by *PETrainer* EML.

BNC Connectors Ext. In and Ext. Out

These BNC connectors allow the Analyzer to transmit or receive external signals. External signaling, in turn, can serve two functions:

- **Linking of Analyzers:** On dual Analyzer systems, the BNC connectors are used to create a loop for transmitting clocking information and commands between the Analyzers. This linking allows the two Analyzers to function as a single, logical Analyzer.
- **Triggering:** The **Ext. In** can receive a signal from another device and use that signal to trigger the end of the recording. Conversely, the **Ext. Out** connector can be used to send an output signal from the Analyzer to another device.

The **Ext. In** and **Ext. Out** connectors have the same function as the 25 pin RS-232 connector - i.e., they channel input and output signals but do not support the use of a Breakout Board.

The BNC connectors are not used for the *PETrainer* Exerciser.

Wide-range AC Connector Module

- Power socket
- Power on/off switch
- Enclosed 5x20 mm 2.0A 250 V fast acting glass fuse

Warning! For continued protection against fire, replace fuse only with the type and rating specified above.

2.9 Specifications for PETracer EML/PETrainer EML

The following specifications describe a combined PETracer EML or PETrainer EML and Universal Protocol Analyzer System (UPAS).

Package

Dimensions	UPAS 100K: 11.5 x 5.75 x 16.25 inches (29.21x 14.6x 41.275cm) PETracer EML Plug-in: 9.16x 6x 1.25inches (23.26x 15.24x 3.175cm) PETrainer EML Plug-in module (2 per platform) 9.16 x 6x 1.25 inches (23.26 x 15.24 x 3.175 cm)
Connectors	PETracer EML: 2 Probe Data PETrainer EML: Two Data Probe Connectors (Molex VHDCI) UPAS AC power connection External trigger connection (TRIG IN/OUT, BNC) 2 High Speed Expansion Ports (SFP) (Sync In, Sync Out) PC connection (USB 2.0) Breakout Board (type D)
Weight	UPAS 100000: 9.5 lbs (4.3 kg) PETracer EML Plug-in: 1.7 lb (0.77 kg) PETrainer EML Plug-in: 1.7 lb (0.77 kg)

Power Requirements

90 to 254 VAC, 47 to 63 Hz (universal input), 100 W maximum

Environmental Conditions

Operating Temperature	0 to 40 °C (32 to 104°F)
Storage Range	-20 to 80 °C (-4 to 176°F)
Operating Humidity	10 to 90%, non-condensing
Operating Altitude	Up to 6560 feet (2000 meters)

Switches

Power	On/Off
Manual Trigger	When pressed forces a trigger event

Indicators (LEDs)

UPAS:

Power	Illuminated when Analyzer is powered on
System Status	Illuminates during initialization/power up of UPAS. Blinks if Power On Self Test (POST) fails.
Triggered	Illuminates when a trigger event occurs.
Slot 1 Status	Illuminates when the Analyzer in Slot 1 is recording
Slot 2 Status	Illuminates when the Analyzer in Slot 2 is recording

PETracer EML Plug-in LEDs:

Activity	Illuminated when the Analyzer is actively recording traffic data
Cable Setup	Illuminates when cable is correctly connected between front of Analyzer and Interposer.

Probing Characteristics

Connection	PETracer EML: PCI Express Slot Interposer PETrainer EML: Slot Interposer card/Device Emulation Interposer (end-point emulation) Test Fixture (Root Complex emulation)
------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

PETracer Recording Memory Size

4 GB per direction for CATC Trace capture, timing, and control information.

PETracer Basic Trigger Events

TLP Headers	TLP Type: Mem, I/O, Cfg, Msg, Cpl, Any Traffic Class number
DLLP Messages	Ack/Nak, InitFC1, InitFC2, UpdateFC, PM, Vendor
Link Conditions	Link Alive, Electrical Idle Link Condition, TS1 Ordered Set, TS2 Ordered Set, Skip Ordered Set, Electrical Idle Ordered Set, FTS Ordered Set, DLLP, TLP, Training Control Bits
Payload	Customizable Payload, Mask, Match
Errors	DLLP CRC, TLP CRC, Delimiter, EDB (End-of-Bad Packet), Disparity, Symbol, Idle Data Skip Late DLLP Ordered Set Format

Breakout Board (BOB)

Filter in/out capabilities

PETracer Reporting and Statistics

Transport Layer Packet	Memory Read 32-bit, Memory Read 64-bit, Memory Write 32-bit, Memory Write 64-bit, I/O Read Request, I/O Write Request, Configuration Read Type 0, Configuration Write Type 0, Configuration Read Type 1, Configuration Write Type 1, Message, Message with Data, Completion, Completion with D for Locked Memory Read with Data, Requesters, Completers, Traffic Class Number, Virtual Channel ID Number
Data Link Layer Packet (DLLP)	Ack, Nak, PM, Vendor, InitFC1-P, InitFC1-NP, Init-FC1-Cpl, Update FC-P, Update FC-NP, Update FC-Cpl, InitFC2-P, InitFC2-NP, Init-FC2-Cpl, Flow Control
Link Transactions	Implicit, Explicit, Incomplete
Split Transaction	Successful Completion, Unsupported Request, Cfg Request Retry, Completer Abort, Incomplete
Error Reports	Bad ECRCs, Bad LCRCs, Invalid 10b code, Running Disparity Error, End of Bad Packet, Delimiter Error, TS Data Error, Ordered Set Format Error, Idle Error

PETrainer Script Memory Size

4 GB for CATC Trace generation, timing and control information

Host PC Software Requirements

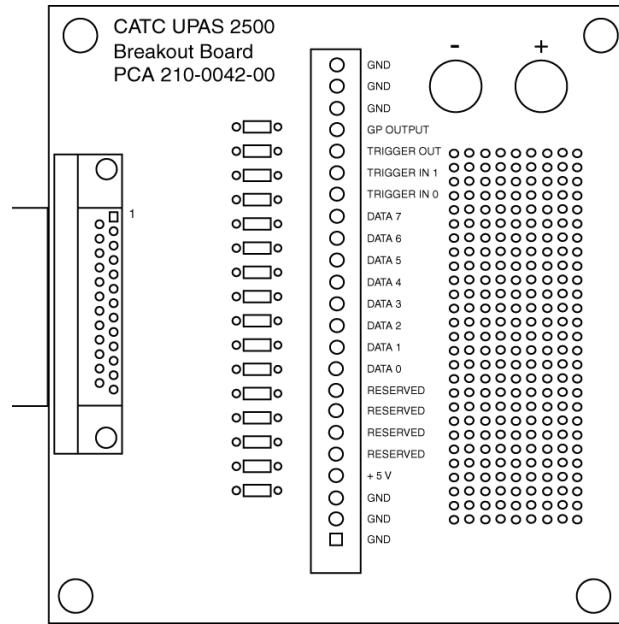
Operating System Windows® XP and Vista

PETrainer Wait Conditions

- Time-Based Wait
- Wait for User Input
- Wait for DLLP, TLP, or Ordered Set

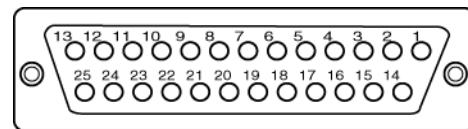
2.10 External Interface Breakout Board

With each Analyzer, LeCroy includes an External Interface Breakout Board for accessing several potentially useful standard, LV TTL output and input signals. The Breakout Board also offers a simple way to connect logic Analyzers or other tools to the PETracer EML Analyzer unit. Six ground pins and one 5-volt pin are provided.



The Breakout Board connects via a cable to the **Data In/Out** connector located on the rear of the Analyzer unit. Each signaling pin is isolated by a $100\ \Omega$ series resistor and a buffer inside the Analyzer unit.

Data In/Out Connector (on cable)



Pin-Outs for the Data In/Out Connector

The following table lists the pin-out and signal descriptions for the **Data In/Out** connector on a cable that connects to the Breakout Board.

Data In/Out Connector – Pin-Out

Pin	Signal Name	Signal Description
1	RSV	Reserved
2	GND	Ground
3	GP OUT	General Purpose Output
4	TRG IN 1	Trigger In 1
5	GND	Ground
6	DATA 6	Data 6
7	DATA 4	Data 4
8	DATA 3	Data 3
9	DATA 1	Data 1
10	GND	Ground
11	RSV	Reserved
12	RSV	Reserved
13	+5V	+5 Volts, 250 mA DC Source
14	RSV	Reserved
15	GND	Ground
16	TRG OUT	Trigger Out
17	TRG IN 0	Trigger In 0
18	DATA 7	Data 7
19	DATA 5	Data 5
20	GND	Ground
21	DATA 2	Data 2
22	DATA 0	Data 0
23	GND	Ground
24	RSV	Reserved
25	RSV	Reserved

Note: (*) Pins 4 and 17 have the same function: they allow external signals to be used to cause triggering or recording. Pins 3 and 16 are used to transmit output signals. Pins 6, 7, 8, 9, 18, 19, 21, and 22 (data pins) are used to define data patterns for external input signals.

Note: All models of PETracer only support Data 0 - Data 3.

Prototype Rework Area

The Breakout Board contains a prototype rework area for making custom circuits for rapid development. The area consists of plated-through holes, 20 columns wide by 27 rows long. The top row of holes is connected to GND and the bottom row is connected to +5V. The remaining holes are not connected. Use the rework area to insert custom components and wire-wrap their respective signal, power, and ground pins.

Breakout Board Input and Output Signals

A Breakout Board can be used to channel input signals into the Analyzer in order to cause triggering. A Breakout Board can also be used to channel signals from the Analyzer to an external source.

Drive strength for all outputs is about 30 mA high (@2 V) and 60 mA low (@0.5 V). Inputs can handle 0 V to 5.5 V. Inputs above 2 V are detected as logic high; inputs below 0.8 V are detected as logic low.

The Breakout Board connects via a cable to the Data In/Out connector on the rear of the UPAS.

External Recordable Signals

Breakout Board Data 0-3: These pins let you define a 4-bit Data Pattern that can be recorded in a CATC Trace file.

External Input Triggers

You can use either an external input signal or the Trigger button on the front of the UPAS to cause triggering. The following descriptions show what pins or buttons to use:

Breakout Board Data 3 - Data 0: Triggers on a 4-bit input pattern.

Breakout Board Trigger In 0: Selectable Edge triggered inputs. Triggers on any edge it detects.

Breakout Board Trigger In 1: Selectable Edge triggered inputs. Triggers on any edge it detects.

BNC Trigger (EXT IN): Selectable Edge triggered inputs. Triggers on any edge it detects. Located on the back of the chassis.

Push Button Trigger: The Trigger button on the front of the UPAS can be pressed to manually cause a trigger.

External Outputs

The Analyzer can be configured to send an external signal anytime a trigger and/or event occurs. The following descriptions show the behavior of these output signals:

Breakout Board Trigger Out: Changes from low to high when Analyzer triggers (one time per recording only)

Breakout Board G.P. Output: Programmable waveform (low or high pulse, toggle). Each event can be programmed to enable this external signal.

BNC Output (EXT OUT): Same as Breakout Board G.P. Output. Located on the back of the chassis.

Setting Recording Options to Support External Input/Output Signaling

After a Breakout Board has been connected to a UPAS, the Analyzer must be configured for external or internal input signaling.

Chapter 3: Installation

PETracer EML™ is a factory-installed hardware module that is sold as part of the Universal Protocol Analyzer System 100K (UPAS 100K).

PETrainer EML™ consists of two factory-installed hardware modules that are sold as part of the Universal Protocol Analyzer System 100K (UPAS 100K).

The UPAS 10K, UPAS 100K, modules, and associated software are easily installed. You can begin making PCI Express™ recordings or begin traffic generation after following the steps in this chapter.

3.1 Installing the PETracer Software

PETracer software operates all of LeCroy's PCI Express protocol Analyzer and Exerciser products:

The PETracer software is installed on a Microsoft® Windows®-based PC and serves as the interface for the Exerciser and/or Analyzer. When an Exerciser is attached, traffic generation features are enabled.

To install the PETracer software on the Host PC:

Step 1 Insert the CD into the CD ROM drive of the PC that controls the Analyzer or Exerciser. The installation window opens and displays links to the PETracer software, user manuals, a readme file, and Acrobat Reader.

Step 2 Select **Install Software** and follow the onscreen instructions.

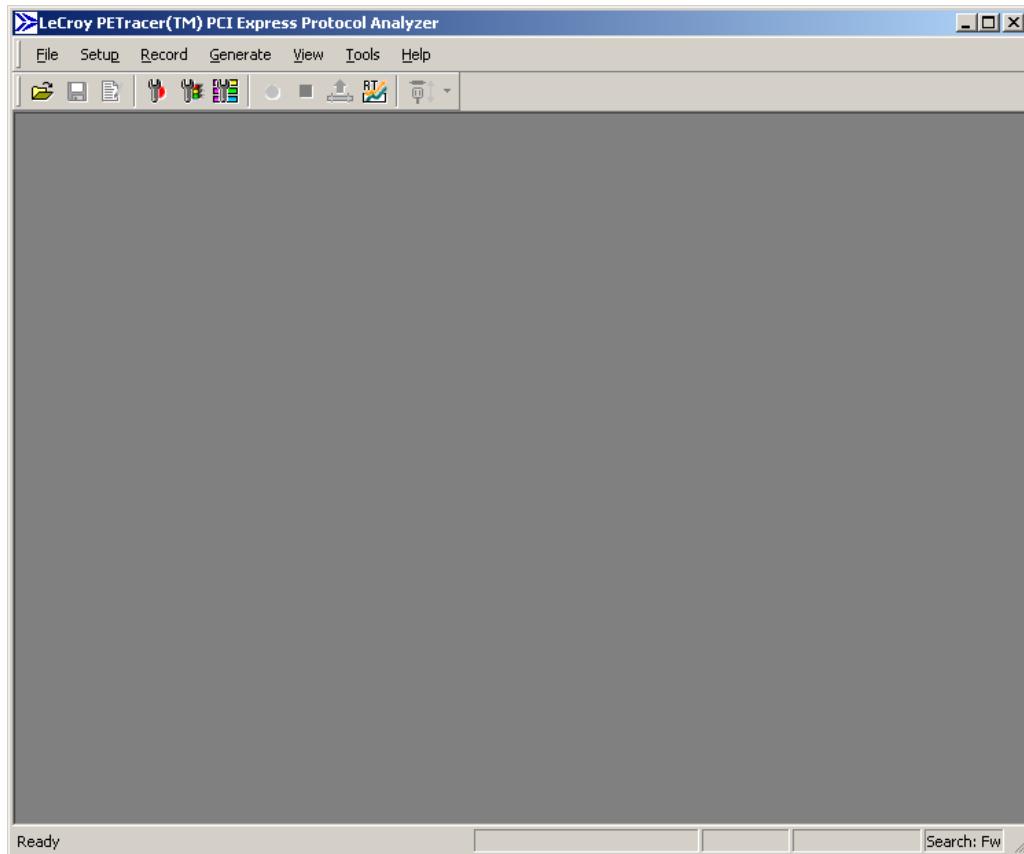
The PETracer software installs automatically on the PC hard disk. During installation, all necessary USB drivers are loaded automatically. Drivers included in the installation are:

- **upas100k.sys:** UPAS 100K driver, PETracer EML and PETrainer EML driver

Step 3 To start the application, launch the PETracer program from the Start menu:

Start > Programs > LeCroy > PETracer > LeCroy PETracer

The PETracer program opens:



Note: The software may be used with or without the Exerciser or Analyzer. When used without an Exerciser or Analyzer attached to the computer, the program functions as a Trace Viewer to view, analyze, and print captured traffic.

3.2 Setting Up a PETracer Analyzer

Step 1 Remove the Analyzer/UPAS from its shipping container. The module is already installed in the UPAS.

Step 2 Connect the Analyzer unit to a 100-volt to 240-volt, 50 Hz to 60 Hz, 120 W power outlet using the provided power cord.

Note: The Analyzer is capable of supporting supply voltages between 100 volts and 240 volts, 50 Hz or 60 Hz, thus supporting all known supply voltages around the world.

Step 3 Connect the USB cable between the USB port on the back of the Analyzer and a USB port on the PC.

Step 4 Turn on the power switch on the rear of the UPAS.

Note: At power-on, the Analyzer initializes itself in approximately five seconds and performs an exhaustive self-diagnostic that lasts about fifteen seconds. The Status LED of the UPAS base unit turns red on power up/initialization. The LED remains on approximately 20 seconds while the Analyzer performs self-diagnostic testing. If the diagnostics fail, the Status LED blinks red, indicating a hardware failure. If this occurs, call LeCroy Customer Support for assistance.

Step 5 Follow on-screen Plug-and-Play instructions for the automatic installation of the Analyzer as a USB device on the Host PC (the required USB files are included on the CD). Step through the Windows® hardware wizard. If the wizard prompts you for driver information, point it to the CD which should be in your disk drive.

The host operating system detects the Analyzer and begins to install the USB driver.

3.3 Setting Up a PETrainer Exerciser

Step 1 Remove the Exerciser and UPAS from its shipping container. The PETracer EML module is already installed in the UPAS.

Step 2 Connect the Exerciser to a 100-volt to 240-volt, 50 Hz to 60 Hz, 120 W power outlet using the provided power cord.

Note: The Exerciser is capable of supporting supply voltages between 100-volt and 240-volt, 50 Hz or 60 Hz, thus supporting all known supply voltages around the world.

Step 3 Connect the USB cable between the USB port on the back of the UPAS and a USB port on the PC.

Note: All hardware and cables should be setup prior to power-up. Install Device Emulator or Host Emulator as described in the previous sections. Also install any cables between the Emulator and PETrainer EML Exerciser as described in the previous sections.

Step 4 Turn on the power switch on the rear of the UPAS.

Note: At power-on, the Exerciser initializes itself in approximately five seconds and performs an exhaustive self-diagnostic that lasts about fifteen seconds. The Status LED of the UPAS base unit turns red on power up/initialization. The LED remains on approximately 20 seconds while the Exerciser performs self-diagnostic testing. If the diagnostics fail, the Status LED blinks red, indicating a hardware failure. If this occurs, call LeCroy Customer Support for assistance.

Step 5 Follow on-screen Plug-and-Play instructions for the automatic installation of the Exerciser as a USB device on the Host PC (the required USB files are included on the CD). Step through the Windows® hardware wizard. If the wizard prompts you for driver information, point it to the CD which should be in your disk drive.

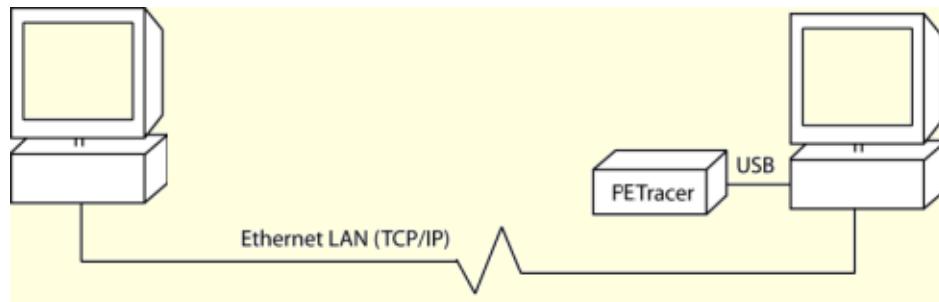
The host operating system detects the Exerciser and begins to install the USB driver.

3.4 Networking an Analyzer

PETracer™ has a networking capability that allows users to run an Analyzer remotely over an IP-based LAN. Using the Network browse dialog, you can locate and connect to other PC hosts on the LAN, which, in turn, are connected to Analyzers. Through this connection, you can remotely control an Analyzer.

Setup for IP LAN Use

In order to connect to a remote Analyzer, the Analyzer must be attached to a PC that is on the LAN. This PC must have PETracer installed.

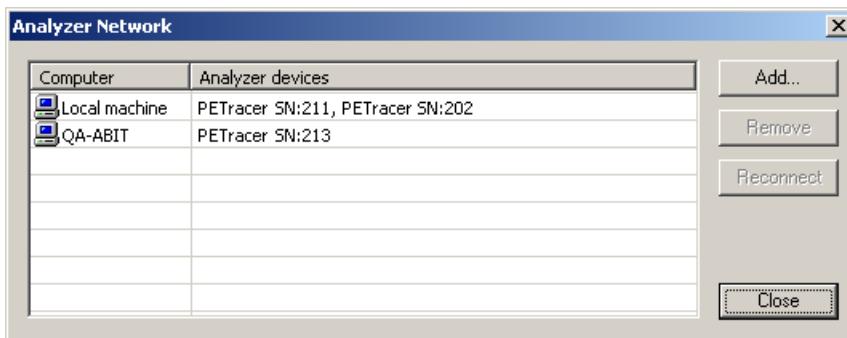


3.5 Browsing to a Networked Analyzer

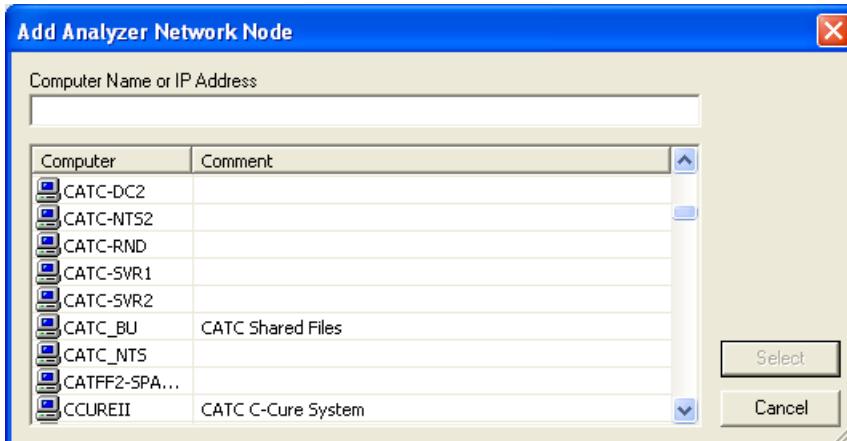
For the PETracer EML and the PE Trainer EML, you can browse to a networked analyzer.

To browse to a networked Analyzer:

- Step 1** From the menu, select **Setup > Analyzer Network**. The Analyzer Network dialog box opens. Locally connected Analyzers (connected via USB) display in the list. The list may also show PC hosts and Analyzers identified in previous sessions.



- Step 2** If the desired host and Analyzer are not present in the list, click **Add**. The Add Analyzer dialog box opens.



- Step 3** Browse to the PC host that has the Analyzer(s), then click **Select**. The selected host and its Analyzer appear in the Analyzer Network browse dialog.

Note: The Analyzer must be turned on before it appears in the list.

- Step 4** Remove hosts and Analyzers you do not intend to use in the current recording session by selecting them from the list and clicking **Remove**.

The PETracer software establishes a connection to the selected Analyzer.

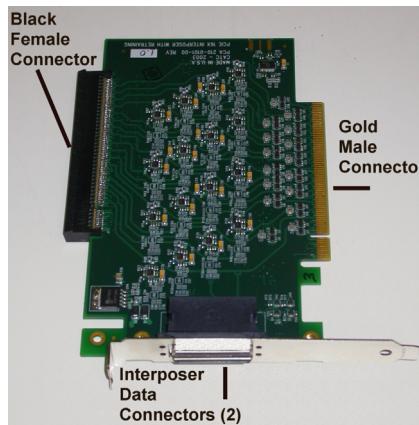
3.6 Connecting the PETracer EML Analyzer to the Device Under Test



PETracer EML Components

PETracer EML components used in the installation are:

- **Probe Data Cable (2):** Each cable supports x16 data from one direction.
- **PETracer EML x16 Slot Interposer:** The slot Interposer provides the point of attachment for the Analyzer to the Device Under Test (DUT). The Interposer is designed to fit between a motherboard and one of its cards - for example, a LAN card. The Interposer has three sets of connectors: a gold male connector that fits into a standard x16 PCI Express slot on a motherboard, a black female connector that accepts a x16 PCI Express device such as a graphics card, and two Interposer cable connectors that connect the Interposer to the Analyzer.



- **USB Cable:** Connects the UPAS 100K to the host PC running the PETracer software.

Installing the Interposer

To install the Interposer, perform the following steps.

Step 1 If not already powered off, power off the UPAS 100K Analyzer and the DUTs.

Step 2 Insert the gold male connector on the Interposer probe into a x16 PCI Express slot in the motherboard.

Step 3 Insert the PCI Express DUT into the Interposer's black female device connector.

Step 4 The slot Interposer is shipped from LeCroy with a metal face plate for attachment to a PC case. If you are working with a motherboard that is not in a PC case, you may prefer to remove the metal face plate so the Interposer can sit flat with the motherboard. To remove the face plate, unscrew the two screws that hold it onto the Interposer.

Connecting the Probe Data Cable and USB Cable

To connect the Interposer data cable:

Step 1 Connect the two probe data cables to the Interposer card and to the Analyzer. It does not matter which slot you plug the cables into on the Analyzer as the direction of the data is determined automatically by the software.

Step 2 Connect the provided USB cable between the UPAS 100K Analyzer and the PC host system that runs the PETracer software.

Power On Analyzer and DUT

Step 1 Power on the UPAS 100K. The Analyzer's green Power LED lights, and the red Status LED turns on for approximately 20 seconds while the Analyzer performs self-diagnostics.

Step 2 After the Analyzer's red status LED turns off, power on the PCI Express system under test.

Step 3 Open the PETracer EML software on the PC host system. The Analyzer is now ready for PCI Express traffic recording.

3.7 Connecting PETrainer EML to the Device Under Test



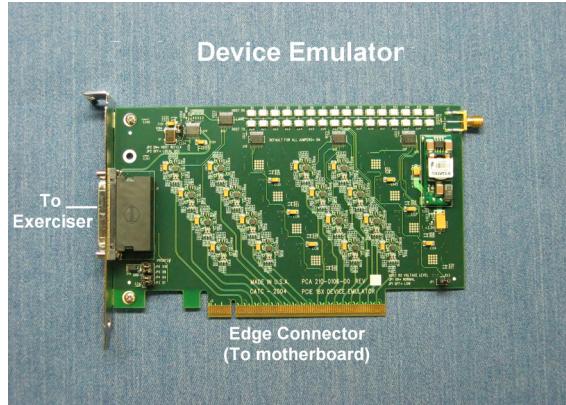
Figure 3.2 PETrainer EML (bottom left) connected to a Host Emulator adapter (top) and a PETracer EML Analyzer (right). The Host Emulator has a PCI Express graphics card inserted.

PETrainer EML can test both the host and device sides of a PCI Express link through the use of two types of adapter:

- **Motherboards and host controllers:** Using a **device emulator**. A device emulator is an adapter card that fits into motherboards and other slotted PCI Express devices.
- **PCI Express add-on cards:** Using a **host emulation test fixture**. A host emulation test fixture is a box-like adapter with a slot for testing PCI Express cards.

Both of these test devices can be purchased from LeCroy.

Device Emulator - Description



The LeCroy Device Emulator is an adapter that provides a way of connecting a PETrainer EML Exerciser to a PCI Express motherboard. The emulator has two connectors: a connector for a data cable and an edge connector for inserting the Device Emulator into a slotted DUT.

Installing the Device Emulator

To install the Device Emulator into the DUT, perform the following steps:

Step 1 If not already powered off, power off the PETrainer/UPAS 100K system and the DUT. The PETrainer power switch is located on the back of the UPAS.

Step 2 Check the Jumper settings. The default is to have all jumpers installed on the device emulator. The jumpers can be used to modify the following:

- **JP1 (Host RX Voltage Level):** This jumper can be removed to reduce the differential voltage level that the DUT receives from the PETrainer to (0.45V - 0.65V). When installed (default) the differential voltage level is (.9V - 1.2V).
- **JP2 (RefClk):** This jumper can be removed for systems that do not provide a 100MHz RefClk to the PCI Express slot. When installed (default), the PETrainer uses the RefClk that is provided by the DUT.
Note: This jumper MUST be installed if the DUT is providing a Spread Spectrum enabled RefClk.
- **JP3-JP6 (PRSNT2#):** These jumpers can be used to open circuit the Presence detect signals driven to the PCI Express connector. When removed, the PRSNT2# signal is floating. When installed (default), the PRSNT2# signal is tied to GND. There are four PRSNT2# signals on the PCI Express connector, one for each lane width (x1, x4, x8, and x16).

Step 3 Insert the edge connector on the Device Emulator into a PCI Express slot in the DUT. The Device Emulator is designed to fit into standard x16 PCI Express slot. To connect to a x1, x4, or x8 slot, you must install a slot reducer, available from LeCroy.

Step 4 The Device Emulator is shipped from LeCroy with a metal face plate for attachment to a PC case. If you are working with a motherboard that is not in a PC case, you may prefer to remove the metal face plate so the emulator can sit flat with the motherboard. To remove the face plate, unscrew the two screws that hold it onto the emulator.

Step 5 Attach probe data cables between the two connectors on the emulator and the **Transmit** and **Receive** ports on the Exerciser.

Step 6 At this point the emulator is ready for use. Skip ahead to Section , “Final Steps: Power On the Exerciser and DUT” on page 39.

Host Emulation Test Fixture - Description



Figure 3.3 Host Emulation Test Fixture with a PCI-E Graphics Card on Top



Figure 3.4 Host Emulation Test Fixture

LeCroy Host Emulation Test Fixture: Hardware enclosure with a slot on top for accommodating a PCI Express card.

Data Cable Connector (To Exerciser Transmit): Connects to the Transmit port on PETrainer EML.

Data Cable Connector (To Exerciser Receive): Connects to the Receive port on PETrainer EML.

Bus Reset button: Reset asserts PERST # for > 250 ms

Signal Level switch:

- Hi = PCI Express compliant (0.9V - 1.2V)
- Low = Testing (0.45V - 0.65V)

Clock Select: Selects from the following clocking options:

- **Ext:** a user supplied reference via the **RefCLK** SMA connector.
- **Int:** an internal supplied 100 MHz reference clock.
- **Int SSC:** an internal supplied Spread Spectrum Clock.

Power Select switch: Selects between the internal power supply and the external power jacks on the back of the emulator unit. When **External** power is selected, both 3.3V and 12V supplies must be provided by the user via the banana jacks on the back of the emulator.

Reference Clk connector: Provides a point of attachment for an external reference clock.

Emulator Power LED: Lights when emulator is powered on.

PCIE Slot Power LED: Lights when the PCI Express connector on the Host Emulator is supplying power. Power can be provided either via the internal power supply or by an external power supply via the banana jacks on the back of the emulator. If an external power source is provided, the Power Select switch should be set to **Ext**.

Installing the Host Emulation Test Fixture

Step 1 If not already powered off, power off the PETrainer/UPAS 100K system and the DUT.

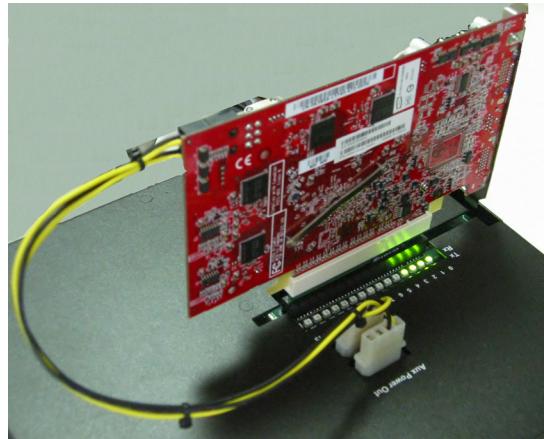
Step 2 Insert the male edge connector of the DUT into the PCI Express slot on top of the Host Emulation Test Fixture. If you are testing a x1, x4, or x8 device, install a slot reducer in the Host Emulator before installing the DUT.

Step 3 Attach a probe data cable to the **To Exerciser Transmit** port on the Host Emulator and the **Transmit** port on the PETrainer.

Step 4 Attach a second probe data cable between the **To Exerciser Receive** port on the Host Emulator and the **Receive** port on the PETrainer.



- Step 5** If the DUT is 150 watt device such as a graphics card, connect the card's external power cables to the two external power ports on top of the Host Emulator.



Final Steps: Power On the Exerciser and DUT

- Step 1** If testing a motherboard, power on the motherboard. If testing a PCI-Express device such as a graphics card, power on the Host Emulator.
- Step 2** Power on the PETracer EML Exerciser. The Exerciser's green power LED lights, and the red status LED turns on for approximately 20 seconds while the Exerciser performs self-diagnostics.
- Step 3** Open the PETracer application on the PC host system. The Exerciser is now ready for traffic generation.
- Step 4** Check the **Cable Setup** LEDs on the front of the Exerciser for indication of proper connectivity.

Optional: Adding a PETracer EML Analyzer

A PETracer EML can be added to the above setup to allow the recording of traffic between the PETrainer EML Exerciser and the device under test. A photo of such a setup is shown in Section 3.7, “Connecting PETrainer EML to the Device Under Test” on page 35. When an Analyzer is added to the setup, a single PC administers both the Exerciser and Analyzer.

- Step 1** Connect a USB cable between the PETracer EML Analyzer and the host PC for PETrainer EML. The same PC administers both devices.
- Step 2** Connect data cables between the two **To Analyzer** ports on the PETrainer EML and the **Data In** ports on the PETracer EML Analyzer.
- Step 3** Connect a power cable to the Analyzer.
- Step 4** Power on the Analyzer.
- Step 5** Start the PETracer application. When both PETracer EML and PETrainer EML are attached and running, the PETracer application detects both platforms. At this point, you are ready to set the Recording Options in PETracer EML and start both traffic generation and trace recording.

Section 2. PETracer Analyzer Software

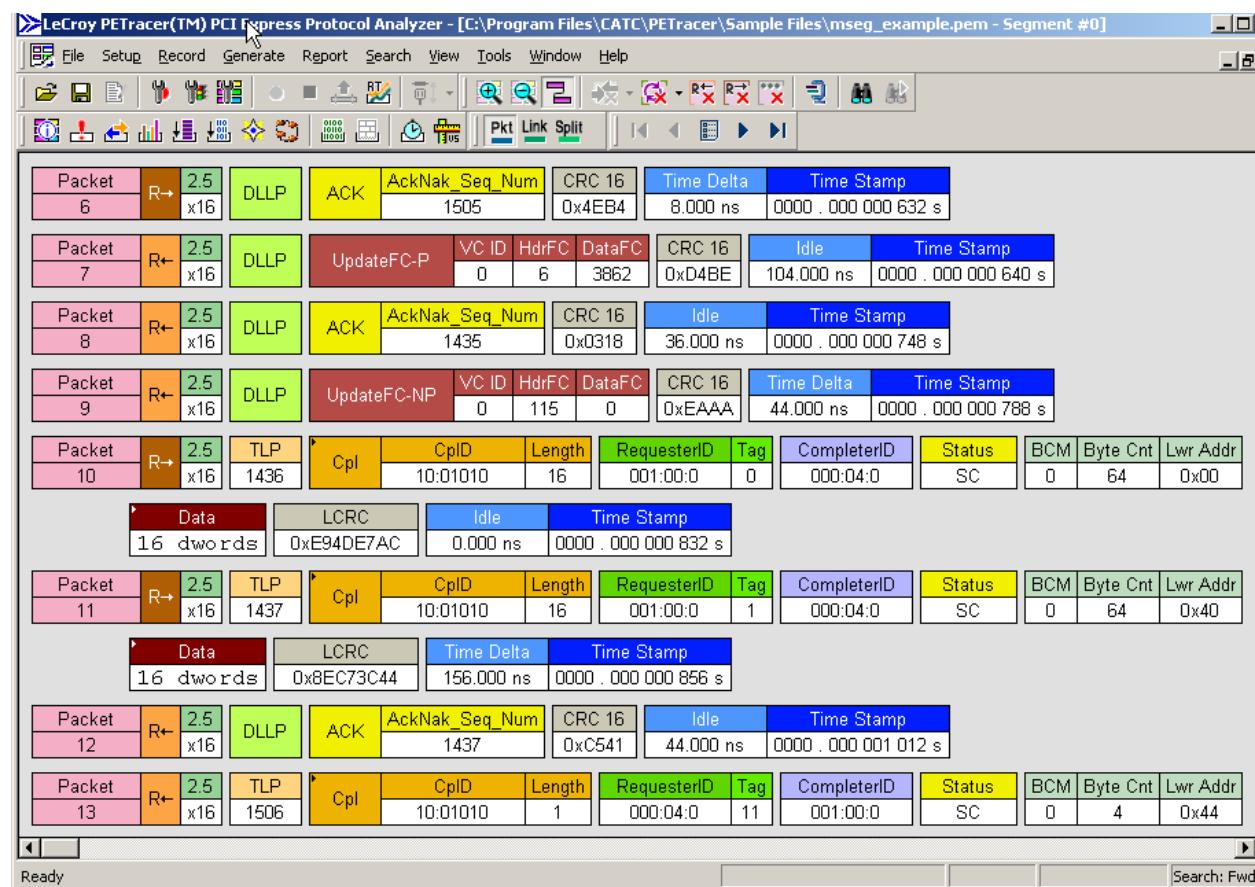
Chapter 4: Software Overview

4.1 The PETracer Software

The PETracer™ software administers Analyzer platforms and handles all CATC Trace analysis and display. When a PETrainer™ Exerciser is present, the software generates PCI Express™ traffic. The core software is thus the same for all of LeCroy's PCI Express products.

The software runs on a Windows®-based PC that is attached to the Analyzer via an Ethernet connection or USB 2.0 connection (USB 1.0 is also supported). PETracer software can be used without the Analyzer as a CATC Trace viewer for viewing, analyzing and printing CATC Traces.

The PETracer software operates in Microsoft® Windows® XP and Vista environments.



4.2 Application Layout

The PETracer application contains the following components:

Title bar: The title bar is at the top of the application window and displays the CATC Trace file name or generation script name.

Menu bar: The menu bar is located below the title bar, by default. The menu bar can be moved by clicking a blank area of the bar and then dragging the menu to a new position. It can be docked in another part of the application window or moved outside of the window to become a floating menu.

Toolbar: The toolbar is composed of buttons that represent the commonly used commands. The toolbar divides into smaller toolbars that can be moved and docked in a new position or made to float outside of the window.

Display area: The display area is the main part of the application window in which CATC Traces are displayed.

Status bar: The status bar is located at the bottom of the application window. The left end of the status bar displays descriptions of buttons and menu items when the mouse is positioned over them. The right end of the bar shows the search direction.

4.3 Using the Toolbar

You can use the PETracer application Toolbar as a shortcut to most of the operations supplied by the menus.



- | | | | |
|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|---------------------------------------------------------------------------------------------------------------------------------------|
| | Opens a previously recorded CATC Trace file. | | Edit as text.
Script Editor. Opens a text editor for editing traffic generation files (*.peg) |
| | Save As
Allows the open file to be saved with a new name. | | |
| | Setup Recording Options
Opens the Recording Options dialog box. | | Setup Display Options
Opens the Display Options dialog box. |
| | Setup Generation Options
Opens the Generation Options dialog box. | | |
| | Start Recording. | | Real Time Statistics monitor
Opens a window that displays real-time information. |
| | Stop Recording. | | Disconnect/Connect Link.
Click once to break and momentarily later restore link. Open menu to select either Connect or Disconnect. |
| | Repeat Upload.
Opens a dialog box that allows you to select a portion of memory to upload from memory, then causes the Analyzer to re-send the CATC Trace from the Analyzer buffer to the host PC. | | |



Zoom in display.



Wraps display information.



Zoom out display.



Hide Training Sequence.



Hide Downstream traffic/recording.



Hide SKIP and Update FC packets.



Advanced Hiding Options
Opens a dialog box that allows you to select items to hide from view.



Hide Upstream recording/traffic.



Compact View
Toggles compacting of training sequences to analyze CATC Trace data faster, or no compacting to display more data.



Find

Opens a dialog box that allows you to select one or more items to find in the recording, then searches to that point.



Find Next. Repeats last Find or Search action.



View Packet Level data.



View Link Transaction Level data.



View Split Transaction Level data

	File Information Lists the conditions under which the recording was made.		Bus Utilization Opens a window that graphically represents various information about the recording.
	Error Report Opens a window that lists all errors identified in the recording.		Link Tracker Opens a window that displays symbol information per lane.
	Traffic Summary Opens a window that lists all events that occurred during the recording		Opens the Data Flow window. Shows recorded data in a compressed tabular format.
	Navigator. Shows/hides the Navigator bar - a utility that lets you easily navigate the CATC Trace.		LTSSM Flow Graph Shows a state diagram of the LinkTraining and Status State machine.
	Displays the Data/Payload window for the current packet.		Displays the Packet Header bar. Opens a window that displays the header information in the current packet, as it would be viewed in the specification.
	Opens the Timing and Bus Usage Calculations window.		Running Verification Scripts Opens a dialog that allows you to select and run verification scripts.

Multi-Segment Toolbar

	First Segment. Open first segment in the multisegment CATC Trace.		Index file. This button becomes active if a multisegment CATC Trace file is open and displays the index file for the recording.
	Previous segment. Open previous segment in the multisegment CATC Trace.		Next Segment. Open next segment in multisegment CATC Trace.
			Last segment. Open last segment in multisegment CATC Trace.

Traffic Generation Toolbar

These buttons appear on the status bar at the bottom of the screen if a PETrainer™ Exerciser is attached. The buttons are explained below.



Start traffic generation



Resume traffic generation.



Stop traffic generation



Trainer Connect. Attempts to establish a G1 connection between PETrainer and the DUT.



Trainer Disconnect. Breaks the connection between PETrainer and the DUT.



Read Address Space

Uploads information currently held in the Exerciser memory space.



Write Address Space

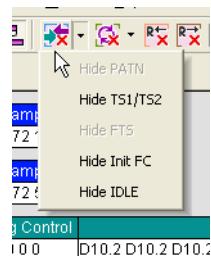
Downloads information into Exerciser memory.

Toolbar Hide Buttons

The PE Tracer application toolbar has five buttons related to show/hide of CATC Trace file contents. The buttons allow you to quickly adjust the CATC Trace display to your needs.



Hide Training: Brings up a drop-down menu that lets you to hide all or a portion of the packets in the training portion of the CATC Trace.



Hide SKIP and Update FC: Brings up a drop-down menu that lets you hide SKIP or Update FC packets in a CATC Trace.



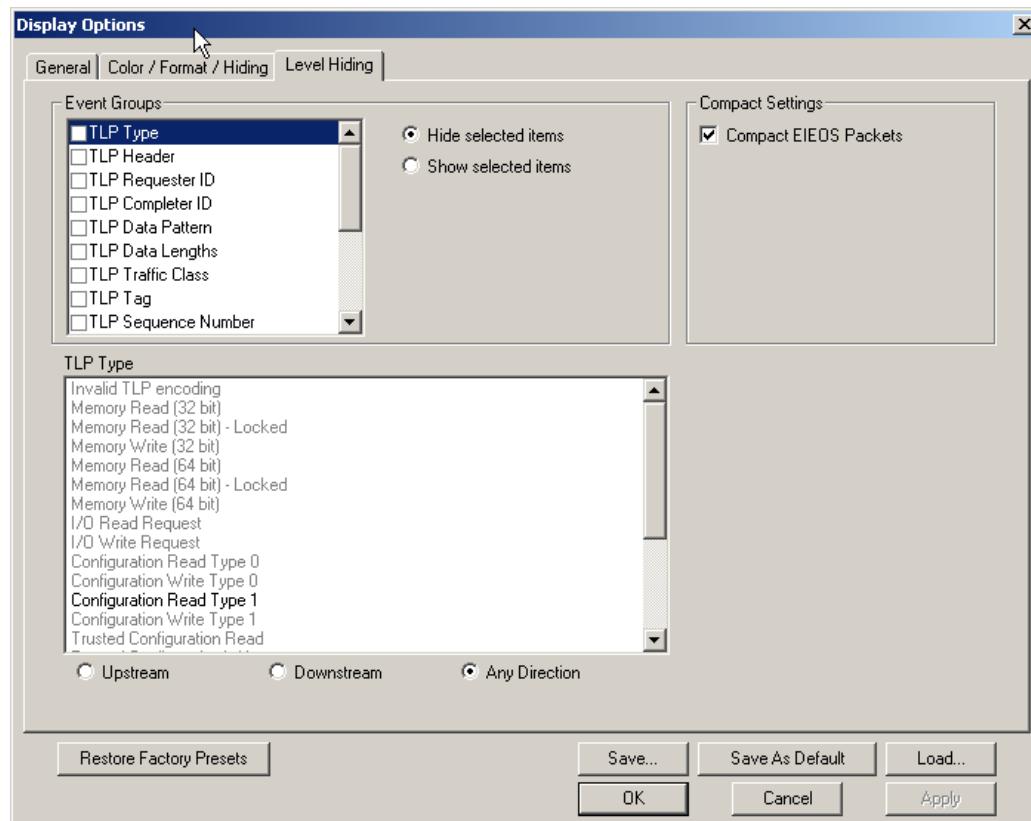
Hide Upstream: Hide all traffic from endpoint devices to the root complex.



Hide Downstream: Hide all traffic from the root complex to endpoint devices.



Advanced Hiding Options: Brings up the Level Hiding pane of the Display Options window. Use this pane to tune the show/hide options within the CATC Trace display.



4.4 Using the Menus

The PETracer application main display includes the following set of pull-down menus:



File Menu

New PETrainer Script	Creates a new Traffic Generation file.
Open	Opens a file.
Close	Closes the current file.
Save as	Saves all or a specified range of packets to a uniquely named file.
Convert Old Files	Convert CATC Trace files made in previous versions of PETracer to the new format for PETracer version 5.0 and higher.
Print	Prints part or all of the current traffic data file.
Print Preview	Produces an on-screen preview before printing.
Print Setup	Setup your current or new printer.
Edit Comment	Create or edit the comment field in a CATC Trace file.
Export >> to Text	Saves all or part of a CATC Trace to a text file or traffic generation file. This text file summarizes the traffic in the CATC Trace.
>> Packets to CSV Text	Saves the CATC Trace to a text file in Comma Separated Value (CSV) format.
>> to Generator File Format	Saves the CATC Trace to a generation file.
Exit	Exit the PETracer application.

Setup Menu

Display Options	Allows you to customize display options such as field colors, field formats and level hiding.
Recording Options	Allows you to customize control and setup features associated with recording, triggering, and filtering recorded events.
Generation Options	The Generation Options dialog box is used to set configuration settings in a traffic generation script (*.peg). This dialog provides a convenient alternative means of editing a traffic generation file.
Generation Macros	Opens a dialog for creating buttons on the status bar that can be used to run traffic generation macros.
Update Device	Opens a dialog box that lets you update the BusEngine™ and Firmware.
Calibrate Device	Opens a dialog box that lets you calibrate the BusEngine™ and Firmware.
Analyzer Network	Displays the list of PCs with connected analyzers or exercisers that you want to use for recording or traffic generation.
All Connected Devices	Opens a dialog box with a list of locally or remotely connected devices. Allows you to update the BusEngine, Firmware, and your licensing information.

Record Menu

Start	Causes the Analyzer to begin recording traffic.
Stop	Causes the Analyzer to stop recording traffic.
Reupload	Causes the Analyzer to re-send all or selected portions of the CATC Trace from the Analyzer buffer to the host PC.
Disconnect/Connect	Causes the Analyzer to momentarily break, and then establish the PCI Express link connection in both link directions.
Reset Link Configuration	Causes the Analyzer to reset the Serdes and thereby reset the Analyzers current link configuration. This command is needed when lane width or other lane settings are changed. Otherwise, the old link configuration is used and errors are generated in the CATC Trace.

Generate Menu

Connect	Initializes the link between PETrainer and the device under test.
Disconnect	Disconnects the link between PETrainer and the device under test.
Write Address Space	Reads PETrainer internal memory used for address space mapping.
Read Address Space	Loads PETrainer internal memory used for address space mapping.

Report Menu

Report Menu operations are only available when you are working with a CATC Trace file.

File Information	Displays the brief information about the file contents and describes the conditions of the file's recording (Recording Options, hardware information, and so on).
Error Summary	Displays an error summary of the current CATC Trace file and allows you to go to a specific packet, and save the error file to a uniquely named file.
Traffic Summary	Details the number and types of packets that were transferred during the recording. You can hide, save, send, text, print, and view.
Bus Utilization	Opens a window with graphs of bus usage for the open CATC Trace.
Link Tracker	Opens a window for displaying a detailed chronological view of traffic. The window provides view and navigation options.
Data Flow	Opens the Data Flow Window, providing a tabular view of transactions and their payload.
Trace Navigator	Shows the Navigator bar for navigating a CATC Trace. Shows a snapshot of the recording and allows you to adjust the memory area for the view.
LTSSM Flow Graph	Shows a state diagram of bus activity. Also allows you to navigate through the LTSSM, based on the current recording.
Packet Header	Opens the Packet Header bar, showing the Packet Header information as it would be viewed in the specification.
Packet Data/View Data	Opens the Data Window for the current packet, with the options: Hide, Save, Hexadecimal, ASCII, Decimal, Binary, MSB Format, LSB Format, Big Endian, and Little Endian. Format Line allows you to enter the number of bytes, words, or dwords per line.
Configuration Space	Presents a list of Configuration Spaces. Clicking an item displays the selected Configuration Space in a Configuration Table format.

Search Menu

Search Menu operations are only available when you are working with a CATC Trace file.

Go to Trigger	Repositions the display to show the first packet following the trigger event.
Go to Packet	Repositions the display to a specific packet, Link Transaction, or Split Transaction number.
Go to Time	Repositions the display to specific timestamp.
Go to Marker	Repositions the display to a previously marked packet, Link Transaction, or Split Transaction.
Go to	Allows searching for specific link events: TLP Type, DLLP Type, .Ordered Set, Link Event, Traffic Class, DLLP Virtual Channel, TLP Virtual Channel, Direction, Speed, Link Width, Requester ID, Completer ID, Data Lengths, Errors.
Find	Displays the Find dialog to allow searching for various events within a CATC Trace. You can search by Display Level: Packets, Link Transactions, Split Transactions. You can search packets by Event Group: TLP Type, TLP Header, TLP Requester ID, TLP Completer ID, TLP Data Pattern, TLP Data Lengths, TLP Tag, TLP Sequence Number, DLLP Type, DLLP Header, DLLP Virtual Channel, ACK/NAK Seq Number, Ordered Sets, Link Event, Direction, Errors. You can search link transactions by Event Group: TLP Type, Traffic Class, Virtual Channel, Direction, Requester ID, Completer ID, Status, Tag. You can search split transactions by Event Group: TLP Type, Traffic Class, Virtual Channel, Direction, Requester ID, Completer ID, Status, Tag. Find allows you to create complex searches based on numerous criteria.
Find Next	Repeats the previous Find or Search operation.
Search Direction	Allows you to specify a forward or backward search of a CATC Trace file.

View Menu

Toolbars>>	Displays available toolbars: Standard, Frequently Used, Analysis, and Transaction Level. Use Customize to display the Windows Customize window.
Script Editor	Displays the Script Editor (only appears if a .peg file is open).
Analyzer Network Chat Bar	Opens a chat window for communicating with persons working with networked Analyzers. This command requires that your host PC be attached to a LAN. The Chat window broadcasts messages to whatever hosts have been connected to via the Analyzer Network command (under Setup in the menu).
Status Bar	Switches display of the Status Bar on or off.
Real Time Statistics	Opens the Real Time Statistics monitor dialog and displays a real-time graph of link activity.
Zoom In	Zoom in increases the size of the displayed elements.
Zoom Out	Zoom out decreases the size of the displayed elements.
Wrap	Allows the display to wrap.
FC Credits	Toggles a display for tracking Flow Control Credit update and consumption on a PCI Express link.
FC Credits Setup	Allows you to customize the display for tracking Flow Control Credits.
Compact View	Toggles compacting of the Link Training sequence to analyze CATC Trace data faster or no compacting to display more data.
Packet Level	View the current recording at the Packet Level.
Link Transaction Level	View the current recording at the Link Transaction Level.
Split Transaction Level	View the current recording at the Split Transaction Level.

Tools Menu

- | | |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Configuration Space Editor | Opens the Configuration Space Editor, allowing you to either create or modify the Configuration Space of the Exerciser. |
| Memory/IO Space Editor | Opens the Memory/IO Space Editor, allowing you to either create or modify memory spaces within the Exerciser. |
| TC to VC Mapping | Allows Traffic Classes to be mapped to Virtual Channels for purposes of simplifying navigation (for example, Search > Go to > TLP Virtual Channel) and changing the way the CATC Trace is displayed (for example, in Split Transactions). |
| Timing Calculations | Starts the mode-less calculator dialog for calculating various timing and bandwidth parameters in the recording file. |
| Run Verification Scripts | Presents a list of verification scripts, from which you can run a verification script. |

Window Menu

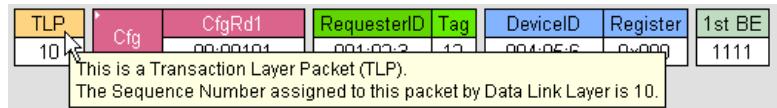
- | | |
|--------------------|---------------------------------------------------------------------------------------------------------------------------|
| New Window | Opens a copy of the current CATC Trace window. |
| Cascade | Displays all open CATC Trace windows in an overlapping arrangement. |
| Tile | Displays all open CATC Trace windows as a series of strips across the display. |
| Arrange Icons | Arranges minimized CATC Trace windows at the bottom of the display. |
| Synchronize Traces | Synchronizes the CATC Trace View windows so that a move in one window repositions the other window of the same recording. |

Help Menu

- | | |
|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Help Topics | Accesses the PETracer application's Online Help. |
| Register Product Online | Register at the LeCroy website registration page. |
| Check for Updates | Check whether a new software version is available. If so, you can download from the LeCroy web site.
You can select to Check for updates at application startup |
| Update License | Displays a dialog box for entering updated license information. |
| Display License Information | Opens an information box describing the current license information. |
| About | Displays version information about the attached Analyzer and its Firmware and BusEngine™. |

4.5 Tool Tips

Tool tips provide details about fields within the CATC Trace. To see a tool tip, position your mouse pointer over a field within the CATC Trace.



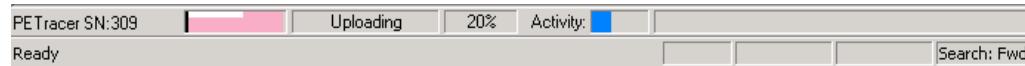
You can turn off this capability in the Display Options menu.

4.6 Keyboard Shortcuts

Keystrokes	Operation
Ctrl + N	New PETracer script
Ctrl+O	Open file
Ctrl+P	Print
Ctrl+S	Save file
Ctrl + R	Start Analyzer recording
Ctrl + T	Stop Analyzer recording
Ctrl+Home	Jump to first packet
Ctrl+End	Jump to last packet
Ctrl + G	Go to packet ...
Ctrl+F	Search forward
F3	Find next
F6	Next pane
Shift+F6	Previous pane
Ctrl+B	Search backward

4.7 Status Bar

The Status Bar is a gray bar that runs along the bottom of the application window.



From left to right:

PETracer SN:309: Analyzer Serial Number

Ready: Analyzer Status

Recording Progress Bar: The colored bar to the right of the serial number represents how much traffic has been recorded. The trigger point is indicated by the black line at the left side of the bar. In this example, the trigger occurred at the very beginning of the CATC Trace. If the trigger is set in the middle of the CATC Trace, the line is positioned in the middle of the bar. Additionally, the color of the bar is different on each side of the trigger point. For examples, see “Recording Progress Bar” on page 60. The white strip along the top edge of the color bar indicates how much traffic has been uploaded from the Analyzer buffer to the host PC.

Uploading and 20%: Indicates the Analyzer’s recording status, what part of the recording process the Analyzer is now in. In this example, the Analyzer is in the upload stage and has completed 20% of the upload from the Analyzer to the PC. See “Recording Status” on page 60 for details on other status messages.

Activity: The colored bar moves to indicate that the Analyzer is currently recording.

Search: Fwd: Indicates search direction. The direction can be toggled to **Search: Bwd** by double-clicking the search direction or by selecting **Search Direction** from the Search menu.

PE Trainer Status Bar

When a PETrainer is attached, a Generation Status bar is displayed at the bottom of the screen. This bar has buttons to start and stop generation and to break and re-establish connection with the DUT. In addition, status info is displayed. See “Using the Toolbar” on page 45 for an explanation of these buttons.

From left to right:

Buttons: Start Generation, Stop Generation, Resume Generation, Start/Establish Connection, Break Connection, Write Address Space, Read Address Space



Status: Link State, InitFC State, Trainer Status

Link State Detect.Quiet	InitFC State Complete	Traffic generation terminated
----------------------------	--------------------------	-------------------------------

Link State Messages on PETrainer Status Bar

When running PETrainer, the status bar displays PETrainer buttons and status information. The buttons allow you to start and stop traffic generation and to create and break links between PETrainer and the DUT.

Link State	InitFC State		
Detect.Quiet	Complete		Traffic generation terminated

The Status bar has a section labeled **Link State** that displays messages about the Trainer link. The following list shows what types of messages can be displayed:

- Detect.Quiet
- Detect.Active
- Polling.Active
- Polling.Compliance
- Polling.Configuration
- Polling.Speed
- Configuration.Linkwidth.Start
- Configuration.Linkwidth.Accept
- Configuration.Lanenum.Wait
- Configuration.Lanenum.Accept
- Configuration.Complete
- Configuration.Idle
- L0
- L0s.Idle
- L0s.FTS
- L1
- L2
- Recovery.RcvrLock
- Recovery.RcvrCfg
- Recovery.Idle
- Loopback
- Hot Reset
- Disabled

InitFC State Messages on PETrainer Status Bar

The Status bar has a section labeled **InitFC State** that displays messages about the Trainer InitFC State.

Link State	InitFC State		
Detect.Quiet	Complete		Traffic generation terminated

The following list shows what types of messages can be displayed:

- Not initialized
- Pending
- Complete

Recording Progress Bar

This indicator bar changes color to reflect the recording progress.

- Black vertical line is at the location of Trigger position.
- Black vertical line wiggles when Trigger Position is nearly reached.
- Field to right of Trigger Position changes color to indicate post-trigger activity.
- Upper half of progress indicator turns white when recording is complete.

Recording Status

The second segment from the left in the Status Bar indicates recording status.

During recording, this status flashes one of the following messages:

- Trigger?
- Triggered!
- Uploading

After recording stops, the message changes to

- Uploading data - x% done (where x equals the percent that has been uploaded.)
As uploading progresses, the percent increases to 100. You can abort this upload if you wish by pressing the <escape> button on your keyboard or

clicking  in the Tool Bar.

Recording Activity

The third segment displays recorded activity. Activity is indicated in blue:



Search Direction Indicator

The fourth segment in the status bar indicates search direction. The direction can be changed by selecting Search Direction from the Search menu.

4.8 Making a PCI Express Recording

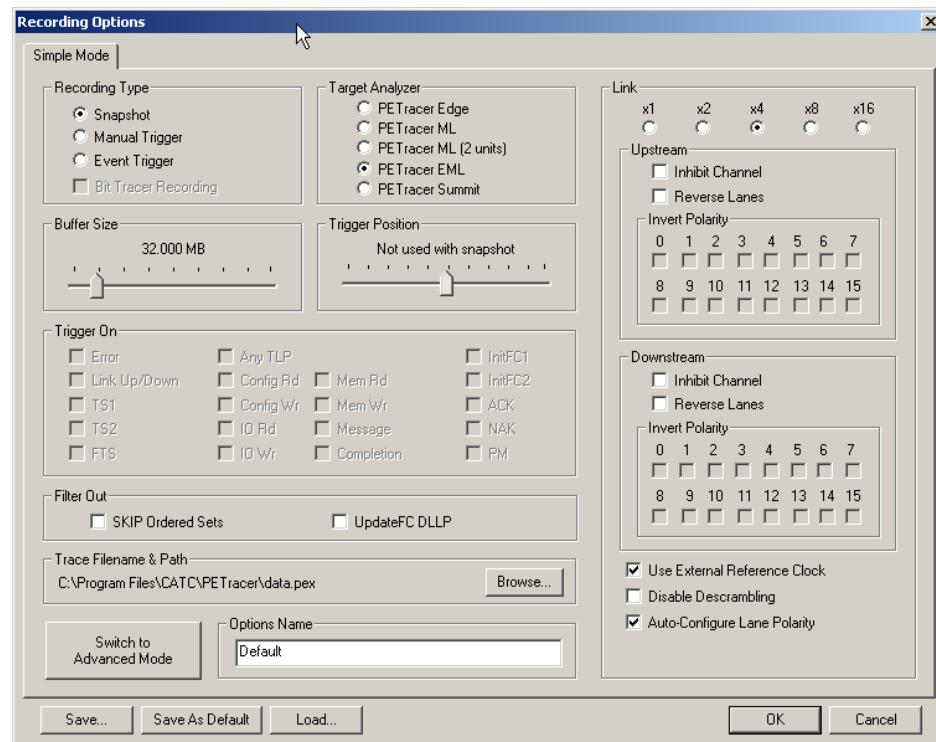
After connecting the Analyzer to the device(s), you must configure the Recording Options. Then you can test the Analyzer by creating a 16-MB snapshot recording.

To make this recording, follow these steps:

Step 1 From the **Setup** menu, select **Recording Options**.

Step 2 Select the **General** tab.

The following window displays the factory default settings in **Simple Mode**, such as Snapshot and 16-MB buffer size. For your first recording, you can leave these settings unchanged.



Step 3 In the **Link** section, specify the lane width of the PCI Express link to be analyzed. The rest of the settings in this section can be left at the factory defaults for most PCI Express systems.

Step 4 For multi-lane PCI Express links, the Analyzer needs to observe link training in order to record link traffic correctly. If link training (or re-training) is not easily controllable for the devices under test, the Analyzer includes the capability to force link training by disconnecting and reconnecting the PCI Express link.

Clicking the **Connect/Disconnect**  button disconnects the PCI Express link for one second in both directions, then re-establishes the link.

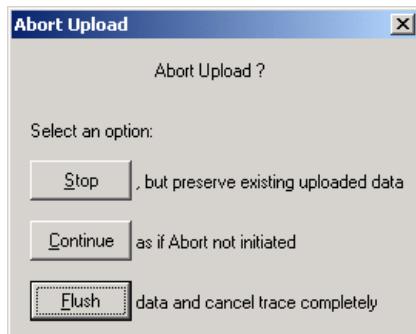
Note: For x1 PCI Express links, it is not necessary for the Analyzer to observe link training in order to record link traffic; this step may be skipped.

Step 5 Click **OK** at the bottom of the Recording Options dialog box to apply the Analyzer recording settings specified.

Step 6 Click the **Record**  button.

Stopping a Recording

You can stop the recording process at any time by pressing the **Stop** button . This causes the Analyzer to stop the recording and upload the CATC Trace to the host PC. If you press the **Stop** button again, the Analyzer temporarily halts the upload process and opens the following dialog box:



This dialog presents options for stopping, continuing, or aborting the upload:

- **Stop:** Aborts further CATC Trace upload and displays whatever CATC Trace data that has already been uploaded.
- **Continue:** Resumes the upload. This command tells the Analyzer to finish uploading whatever CATC Trace data is still in its buffer.
- **Flush:** Flushes the CATC Trace without saving or displaying it.

If you allow the traffic data to be uploaded, it is automatically saved on the PC's hard drive as a file named **data.pex** or the name you assign as the default filename in the recording options.

Saving a Recording

Step 1 To save a current recording for future reference, select **Save As** from the File menu.

Step 2 Give the recording a unique name, then save it to the appropriate directory.

4.9 Recording Multi-Segmented CATC Traces

If **Save as Multisegment trace** is enabled, PETracer divides the CATC Trace as it records it into segments and stores them on the host's hard drive.

This option is useful for very large recordings and for host PCs with limited memory. In the latter case, multi-segmenting gives a PC with limited memory a way to open recordings that are otherwise too large to open.

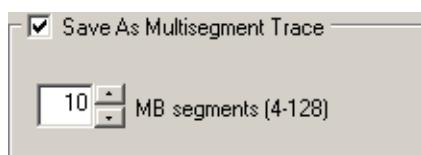
The only downside to multi-segmenting is that limits the scope of reports such as Traffic Summary, Bus Utilization, and Error Summary to each of the segments. You cannot perform summary statistics on the full recording.

The default segment size is 10 MB. Before attempting large recordings, it is recommended that you play with this number to see what value best suits your needs.

How to Create a Multisegment Recording

To create a Multisegment recording:

Step 1 Select **Setup > Recording Options** to open the Recording Options dialog at the General tab. Click **Switch to Advanced Mode**.



Step 2 Check the box marked **Save as Multisegment trace**.

Step 3 In the box marked MB Segments, enter a value of 4 to 128 MB.

What Gets Created

Multisegmenting produces an index file and segmented CATC Trace files. The default name of the index file is **data.pem**.

The index file and the segmented CATC Trace files are stored in a directory named after the index file. The directory is named **data_pem_files**. Below this directory additional, sequentially numbered sub-directories (up to 100,000) hold the segmented CATC Trace files. These sub-directories bear simple numerical names: 00000 to 00999. Each of these subdirectories can hold up to 100 sequentially numbered segment files. Collectively, the entire directory structure can hold up to 10 million files.

Example

If you create a 1010 MB recording using 10 MB segments, the following files and sub-directories are created:

```
data.pem (This is the index file.)  
data_pem_files\00000\segment_00000.pex  
data_pem_files\00000\segment_00001.pex  
...  
data_pem_files\00000\segment_00099.pex  
data_pem_files\00001\segment_00100.pex  
data_pem_files\00001\segment_00101.pex
```

Note: An additional index file is created called **segments.col**. This is an internal system file that users should not modify.

4.10 PETracer Files

The PETracer software creates and uses different kinds of files:

- **Trace Files:** Recorded traffic
- **Recording Options Files:** Configuration file that contains the various options selected in the Recording Options dialog box to configure the recording
- **Display Options Files:** Configuration file that contains the options selected in the Display Options dialog box to configure how traffic is displayed

CATC Trace Files

PETracer records PCI Express traffic into a CATC Trace file with the default name **data.pex** or any other that you specified in the Recording Options. This file is overwritten with new data each time PCI Express traffic is recorded.

When Multisegment CATC Traces are created, a special index file is also created called **<filename>.pem**. This index file provides a high level view of the CATC Trace segments created in the recording session.

If you want to save a CATC Trace, use the **File > Save As** function. This option allows you to save the current CATC Trace to a unique file name, thereby ensuring that it is not overwritten. This option also allows you to save a range of packets in a CATC Trace file.

You can pre-define the name of the recorded CATC Trace file using the Trace Filename and Path option in Recording Options.

Recording Options Files

Recording Options files are created when you set recording options. These files use the **.rec** extension and contain recording option information.

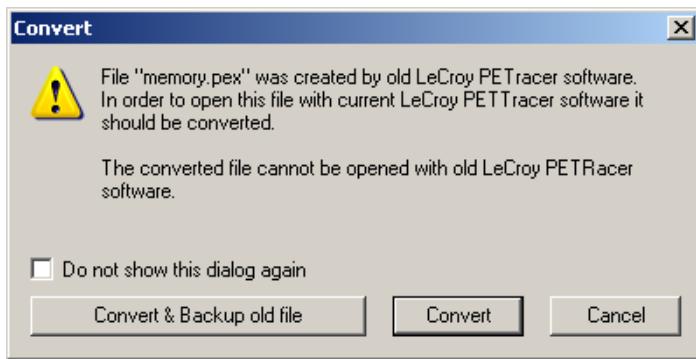
Display Options Files

Display Options files are created when you set display options. These files use the **.opt** extension and contain the display options information.

4.11 Opening CATC Trace Files

To open an existing CATC Trace file, click **File > Open** or .

If the file was made in a previous version of PETracer, the application presents the Convert dialog box:



You must convert CATC Trace files made in previous versions of PETracer for them to open in PETracer version 5.0 or higher. The converted file has all the information that was in the original file.

You can:

- **Convert & Backup old file:** Convert the file, open it in PETracer version 5.0 or higher, and save it with the original name. Save the original file with the same name plus the extension **.bak**.
- **Convert:** Convert the file, open it in PETracer version 5.0 or higher, and save it with the original name.

Note: After you convert a CATC Trace file, you cannot open the converted file in a previous PETracer version.

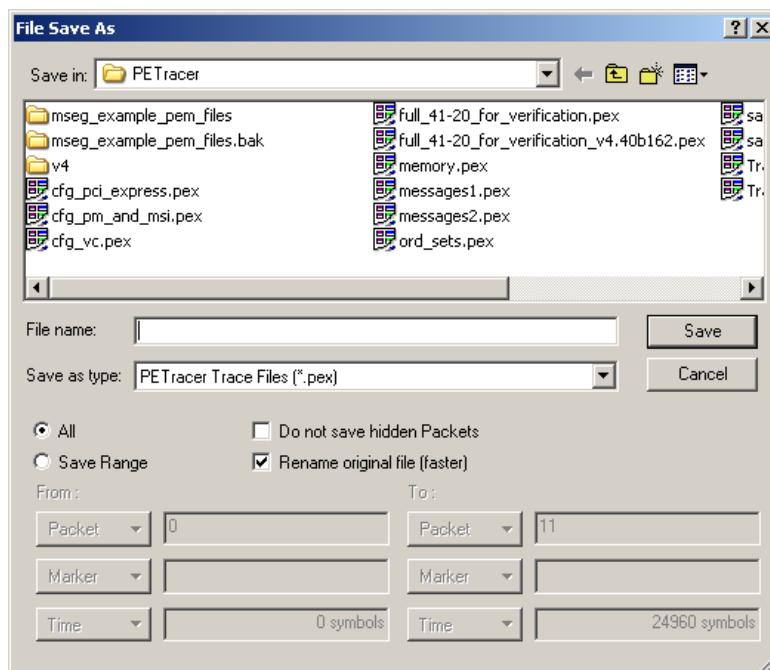
4.12 Saving CATC Trace Files

Using the Save As Function

When you record a CATC Trace file, the Analyzer software provides a pre-defined name to the CATC Trace file (**data.pex** or any other that you specified in the Recording Options). If you do consecutive recordings, each time the previous recording is overwritten. If you see a recording you want to analyze later, you need to give a unique name to the CATC Trace file, so it is not overwritten with the next recording.

Also, when you analyze a recorded CATC Trace file, you might be interested in preserving just a part of the PCI Express traffic that was recorded. If you save a portion of a CATC Trace file, it can get significantly smaller, allowing you to attach it to an e-mail.

To save a portion of a CATC Trace file or the whole file to a unique name, select **Save As** from the File menu.



If you want to give a unique name to the CATC Trace file, select the **All** option and keep **Rename original file** checked. This is the default setting for the dialog.

Saving a Portion of a CATC Trace

If you want to save a portion of a CATC Trace file, select **Save packet range**. Enter starting and ending packet numbers in the **From Packet** and **To Packet** fields. By default, it has the numbers of the first and the last packets in the file. The software is going to save all the packets in specified range to the new file, unless you have **Do not save hidden packets** checked. In this case it is going to save all packets in the range, EXCLUDING the currently hidden packets.

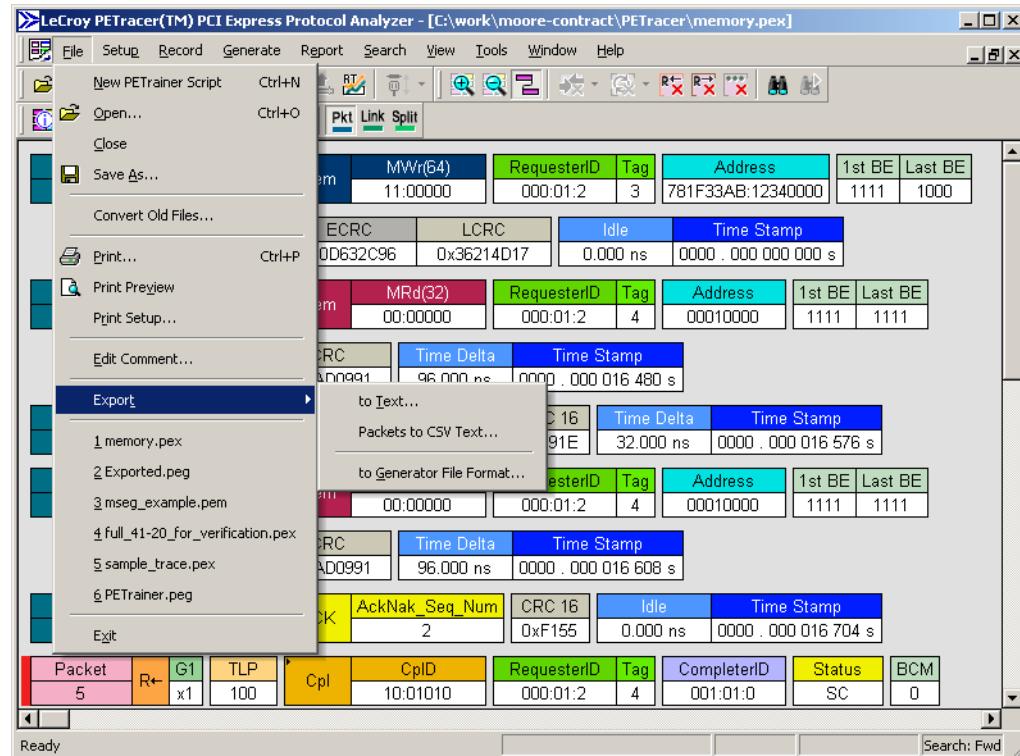
4.13 Exporting a CATC Trace File

By default, PE Tracer saves CATC Trace files in the .pex format. However, you can export a CATC Trace to a file in any of the following other formats:

- Text
- Comma Separated Value (CSV)
- Generator file format

Exporting to Generator file format is a simple way to create a script file from your CATC Trace.

To export a CATC Trace file, select **File > Export**:



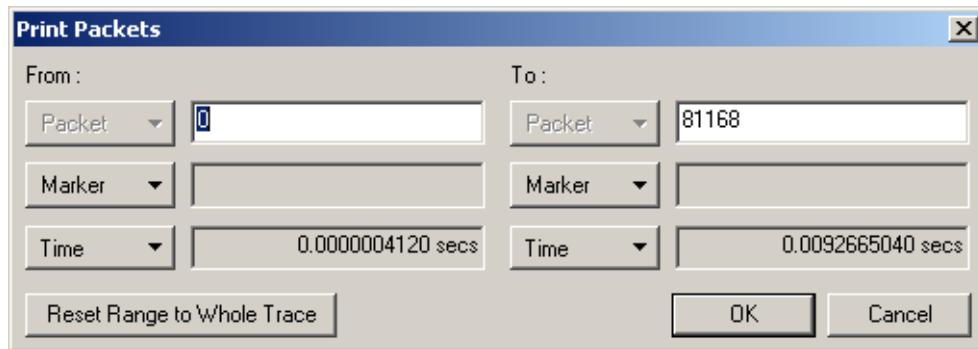
4.14 Printing Data Files

To print all or part of the open CATC Trace:

Step 1 Select **File > Print** from the menu or

click the **Printer**  button on the toolbar.

The Print Packets dialog opens:



Step 2 To select a range of packets, enter values in the **From packet #** and **To packet #** fields and click **Print**.

Step 3 To print an entire file, leave the From and To fields empty and click **Print**.

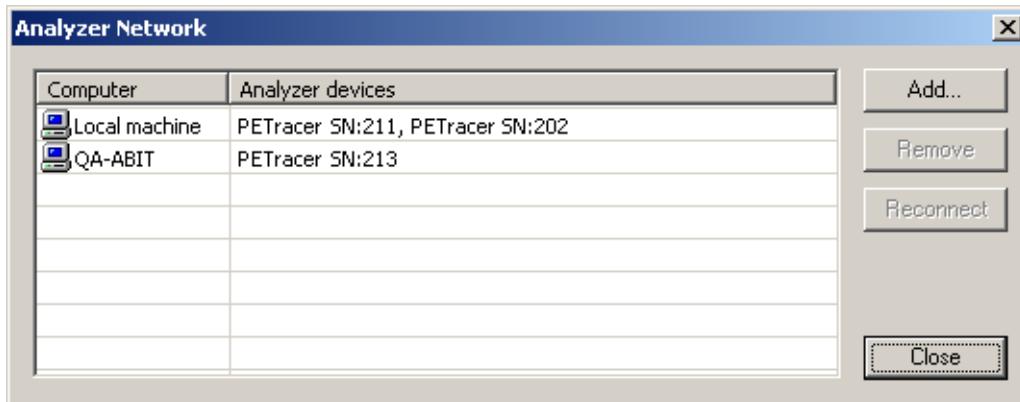
The specified traffic information is printed as currently displayed, in color or gray scale as supported by your printer. Any CATC Trace File comments you entered are printed following the current document name at the top of each page.

Note: CATC Trace File comments can be created by using **Edit Comment** on the File menu.

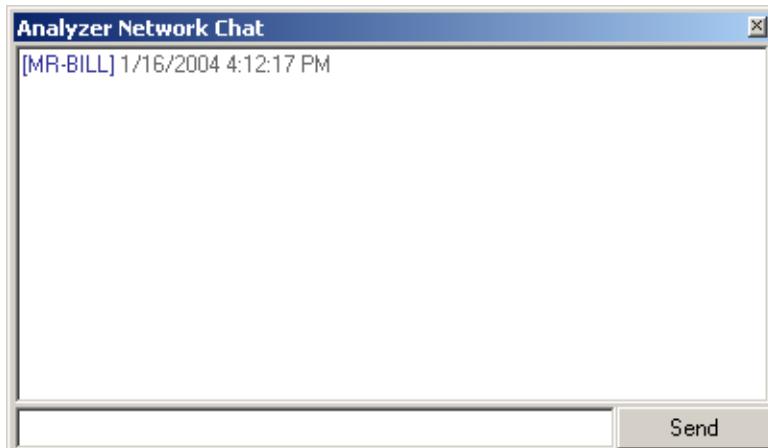
4.15 Analyzer Chat Window

PETracer has a Chat window that allows you to communicate with users on remote PCs. For Chat to work, two conditions must be met:

1. The PC hosts must have PETracer software installed and running.
2. The hosts must be listed in each other's Network Browse list. This means that your PC must have the remote PC listed in its Network Browse window and the remote PC must have your PC listed in its Network Browse window.



If the above conditions are met, a Chat session is initiated by running the command: **View > Analyzer Network Chat Bar**. The following dialog opens.



Enter some text, then press **Send**. The message is then broadcast to all host PCs listed in your network browse window. If a target PC also lists your PC in its Network Browse window, then it can receive your message. When the message arrives, the Chat window automatically opens.

Chapter 5: Reading CATC Traces

5.1 Viewing PCI Express CATC Traces

PETracer™ displays traffic as labeled, color-coded, and time-stamped rows.

Packet	R→	G1	TLP	Mem	MWr(64)	RequesterID	Tag	Address	1st BE	Last BE
0	x1		1	Mem	11:00000	000:01:2	3	781F33AB:12340000	1111	1000
		Data	ECRC	LCRC	Idle	Time Stamp				
		1023 dwords	0xD632C96	0x36214D17	0.000 ns	0000 . 000 000 000 s				

Tool tips provide details about fields within the CATC Trace. Hold the mouse cursor over a field to see a tool tip.

Additional information is available from pop-up menus. For example, if you click the left mouse button on the first cell in a packet a menu appears with an option to view Raw 10b Codes.

5.2 Expand and Collapse Data Fields

Packet data fields are displayed in a short format by default.

You can view a data field's long format by performing one of the following three actions:

- Click the **small triangle** in the left corner.
- Double-click anywhere in the data field.
- Click once in the Data Field with the left mouse button, then choose **Expand Data** from the pop-up menu.

Packet	R→	G1	TLP	Mem	MWr(64)	TC	TD	EP	Attributes	Length	RequesterID	Tag	Address	1st BE	Last BE
0	x1		1	Mem	11:00000	0	1	0	00	1023	000:01:2	3	781F33AB:12340000	1111	1000
															Data
0:	7E234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567
12:	01234567	89ABCDEF	01234567	89ABCDEF	7D234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567
24:	7C234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567
36:	01234567	89ABCDEF	01234567	89ABCDEF	7A234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567
48:	79234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567
60:	01234567	89ABCDEF	01234567	89ABCDEF	77234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567
72:	76234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567
84:	01234567	89ABCDEF	01234567	89ABCDEF	74234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567
96:	73234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567
108:	01234567	89ABCDEF	01234567	89ABCDEF	71234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567
120:	70234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567	89ABCDEF	01234567
						ECRC	LCRC	Idle			0.000 ns	0000 . 000 000 000 s			

A repeat of any above methods causes the display to return to a Short Data format.

5.3 Resizing Cells

Data cells can be resized by pointing the mouse pointer on the edge of a data cell, depressing and holding the left mouse button, and then repositioning the mouse pointer while keeping the mouse button depressed.

5.4 Pop-up Menus

The Analyzer software makes extensive use of pop-up menus. In some instances, pop-up menus provide the only means of accessing dialog boxes that contain detailed information about cells within the CATC Trace, for example, the Show Configuration Space dialog box.

To see a pop-up menu, left-click or right-click a **cell** within the CATC Trace. Right-click or left-click behavior depends on the Display Options setting. For default left-click, the right-click menu is not cell-dependent. For other left-click behavior, the type of menu that opens varies depending on the type of cell that is selected. Take some time to explore CATC Traces and the various pop-up menus.

5.5 View Data Block

To view the raw bits that make up the data in a data field, left-click a data field, then click



or select **View Data Block** from the pop-up menu to display the Data Block window.

Packet 2 (1 dwords)				
Address	Hexadecimal	ASCII	Decimal	Binary
0000000C	FF000100	4278190336	111111100000000000000000000000100000000

You can display data in Hexadecimal, ASCII, Decimal, or Binary formats.

Bit Order is Most Significant Bit or Least Significant Bit.

You can display data in Big Endian or Little Endian.

Format lets you display data as BYTES, WORDs, or DWORDs.

Columns lets you select the number of columns.

You can enter hexadecimal offset values.

You can go to or search Previous or Next.

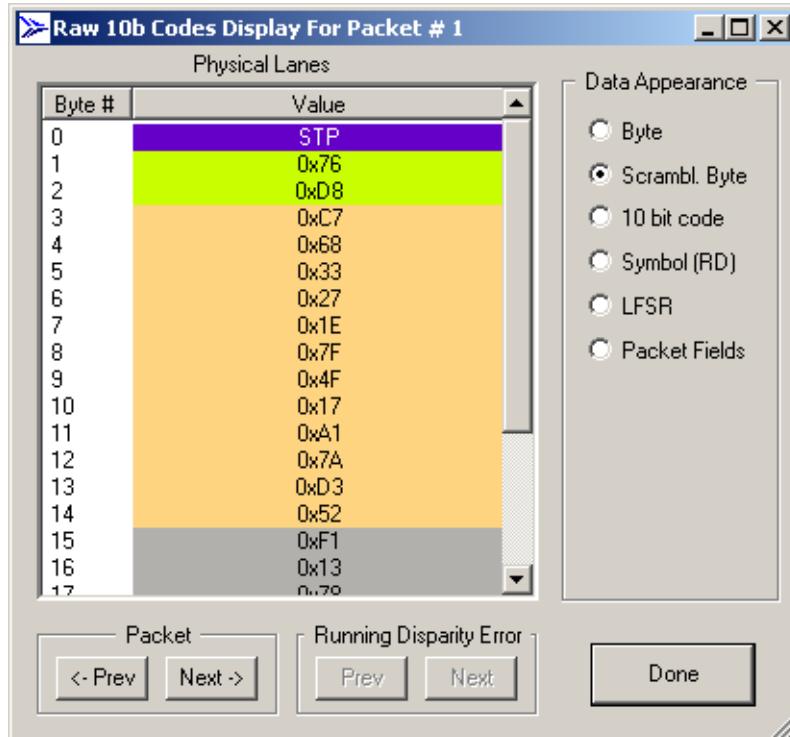
5.6 Show Raw 10b Codes

You can view the raw bits that make up the data field by left-clicking the field and selecting **View Data Block** from the pop-up menu.

To view Raw 10b Codes:

Step 1 Left-click the **first cell** in a packet.

Step 2 Select **Show Raw 10b Codes** from the pop-up menu to display the Raw 10b Codes window.



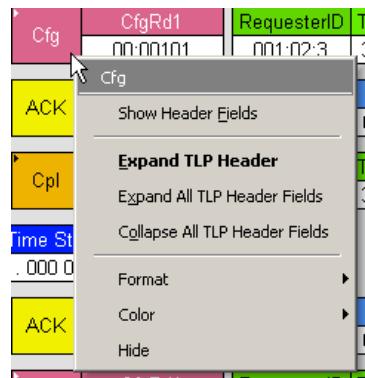
Step 3 To change the format of the data, use the options along the right side of the dialog.

Step 4 To navigate the CATC Trace, use the **Prev** and **Next** buttons.

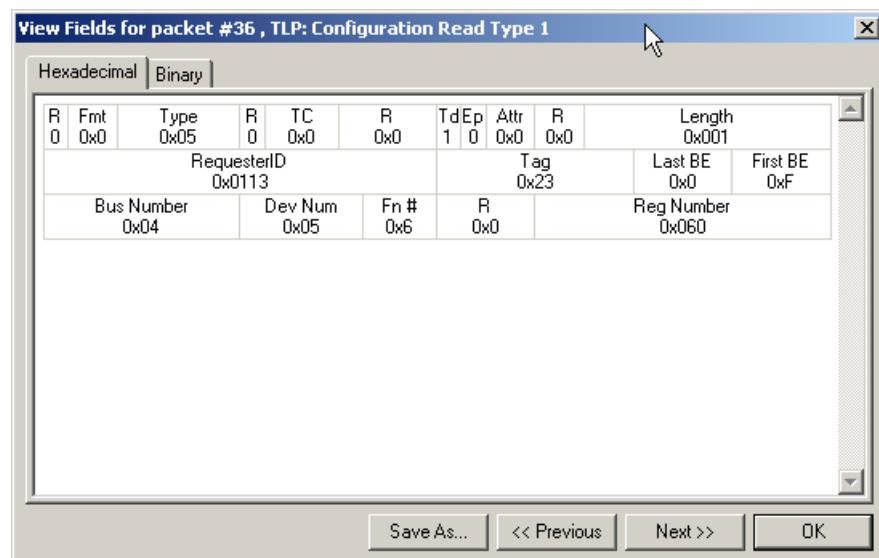
5.7 Show Header Fields

You can view details about header fields by opening the Show Header Fields dialog box.

Step 1 Click a header. A pop-up menu appears.



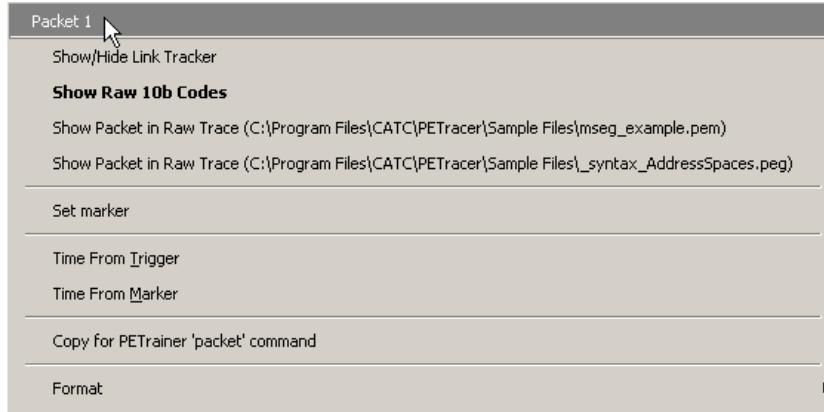
Step 2 Select **Show Header Fields**. The following dialog box opens.



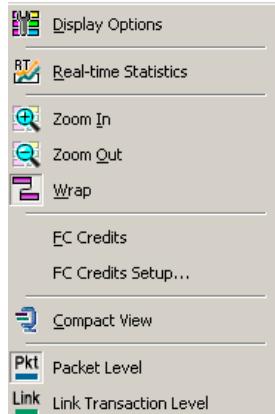
Step 3 Use the **Prev** and **Next** buttons to navigate to other headers.

5.8 Packet Cell Popup Menus

The Packet cell has a left-click pop-up menu that includes the Show Raw 10b Codes command:

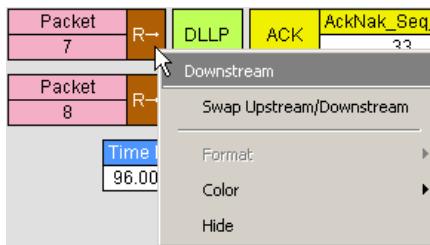


The right-click pop-up menu from Packet cell is:



Packet Header R-> Cell Popup Menu

The Packet Header R-> cell has a pop-up menu with the Swap Upstream/Downstream command, which changes the directionality of the packets in the CATC Trace.



Packet Header G1 Cell Popup Menu

The Packet Header G1 cell has a pop-up menu with the Show Header Fields command (see “Show Header Fields” on page 74), which exposes a detailed view of the selected Header field.

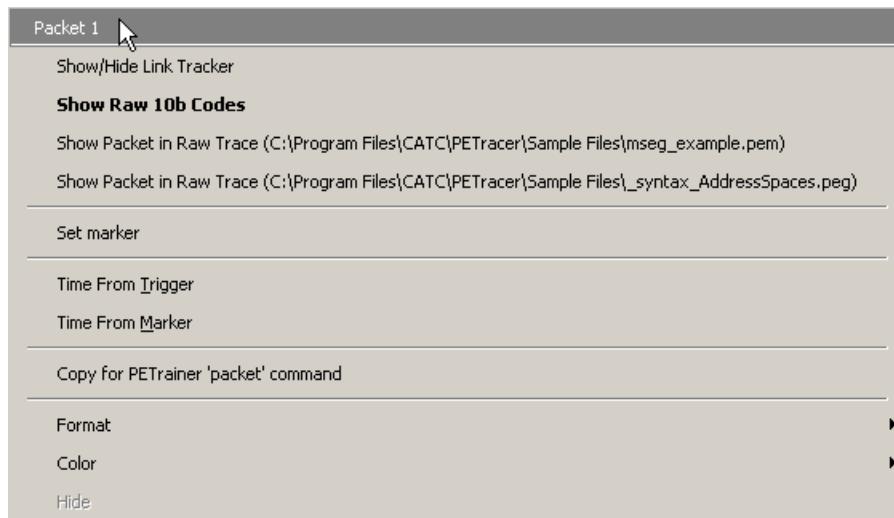


5.9 Set Marker

A marker is a unique label for a packet that allows you to go to that packet and also serves as a **comment string** for a specific packet. When you select a marker, the identified packet appears at the top of the screen. Packets that have been **marked** have a red bar on the left edge.

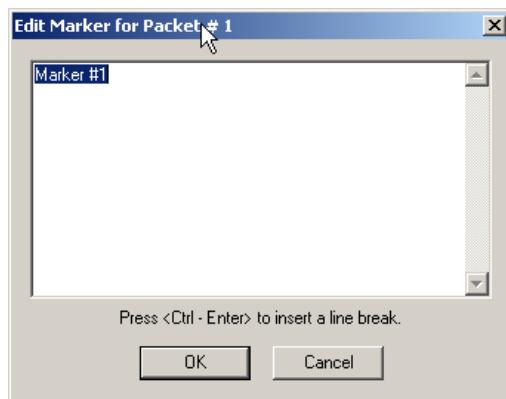
To set a marker, perform the following steps:

Step 1 Left-click the **Packet** field of the packet you want to mark.



Step 2 Click **Set Marker**.

Step 3 When the Edit Marker for Packet # pop-up appears, enter a unique identifier for the packet in the Comment field.

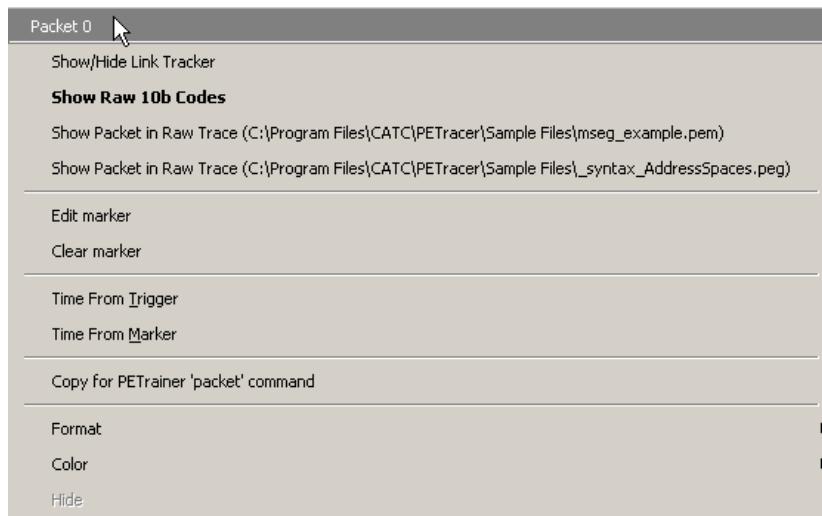


Later, you can go directly to this packet using the Go To Marker operation in the Search Menu.

5.10 Edit or Clear Marker

To change a markers identifier, or clear (delete) the marker:

- Step 1** Left-click the **Packet** field of the desired packet to display a pop-up menu:



- Step 2** Choose **Edit Marker** and enter a new identifier into the Edit Marker for Packer # pop-up, or
Choose **Clear Marker**. When you choose Clear Marker, the marker is removed and the red line disappears.

5.11 Decoding Traffic

The PETracer software has three decode levels:

Packet

Packet level decode  includes all TLP packets, DLLP packets, and all ordered sets.

Packet	R→	G1	TLP	Mem	MWr(64)	RequesterID	Tag	Address	1st BE
0	x1	1			11:00000	000:01:2	3	781F33AB:12340000	1111
	Last BE	Data		ECRC	LCRC	Idle	Time Stamp		
	1000	1023 dwords		0x0D632C96	0x36214D17	0.000 ns	0000 . 000 000 000 s		
Packet	R→	G1	TLP	Mem	MRd(32)	RequesterID	Tag	Address	1st BE Last BE
1	x1	2			00:00000	000:01:2	4	00010000	1111 1111
	ECRC	LCRC		Time Delta	Time Stamp				
	0xA83F0CE	0xA3AD0991		96.000 ns	0000 . 000 016 480 s				

Link

Link level decode  is composed of TLP packets matched with a corresponding ACK or NAK coming from the opposite direction.

Link Tra	R→	G1	TLP	Mem	MWr(64)	RequesterID	Tag	Address	1st BE	Last BE
0	x1	1			11:00000	000:01:2	3	781F33AB:12340000	1111	1000
	Data		ECRC	VC ID	Explicit NAK	Metrics	# Packets	Time Delta		
	1023 dwords		0x0D632C96	0	Packet #2		2	16.480 µs		
	Time Stamp									
	0000 . 000 000 000 s									
Link Tra	R→	G1	TLP	Mem	MRd(32)	RequesterID	Tag	Address	1st BE	Last BE
1	x1	2			00:00000	000:01:2	4	00010000	1111	1111
	ECRC	VC ID	Explicit ACK	Metrics	# Packets	Time Delta	Time Stamp			
	0xA83F0CE	0	Packet #4		3	256.000 ns	0000 . 000 016 480 s			

Split

Split level decode  is composed of two Link transactions, the Request TLP and the Completion TLP from the other direction.

Link Tra	R→	G1	TLP	Mem	MWr(64)	RequesterID	Tag	Address	1st BE	Last BE
0	x1	1			11:00000	000:01:2	3	781F33AB:12340000	1111	1000
	Data		ECRC	VC ID	Explicit NAK	Metrics	# Packets	Time Delta		
	1023 dwords		0x0D632C96	0	Packet #2		2	16.480 µs		
	Time Stamp									
	0000 . 000 000 000 s									
Split Tra	R→	G1	Mem	MRd(32)	RequesterID	CompleterID	Tag	TC VC ID	Address	
0	x1			00:00000	000:01:2	001:01:0	4	0 0	00010000	
	Status	Data	Metrics	# LinkTras	Time Delta	Time Stamp				
	SC	1023 dwords		3	16.848 µs	0000 . 000 016 480 s				

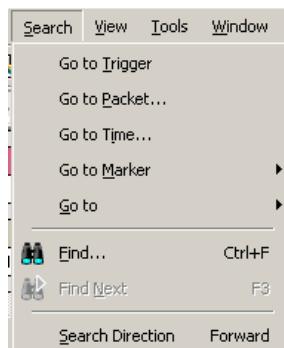
Chapter 6: Searching CATC Traces

This chapter describes how to search for CATC Trace events.

6.1 CATC Trace Search Overview

Several search commands let you navigate a CATC Trace view to search for key events, such as errors and triggers.

To view the search options, click **Search** in the Menu bar.



6.2 Go to Trigger

To position a trigger packet at the top of the screen:

- Select **Search > Go to Trigger**.

6.3 Go to Packet

To position a packet at the top of the screen:

Step 1 Select **Go to Packet** from the Search menu. A pop-up menu prompts you for the packet number, marker, or time.



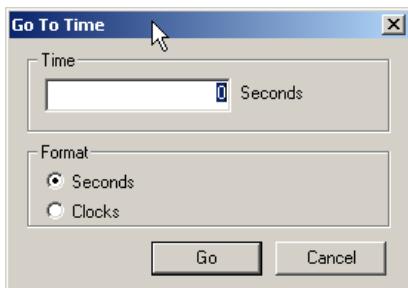
Step 2 Enter the packet number, marker, or time.

Step 3 Click **OK**.

6.4 Go to Time

To position a specific time at the top of the screen:

- Step 1** Select **Go to Time** from the Search menu. A pop-up menu prompts you for the time in Seconds or Clocks.



- Step 2** Enter the time and format (seconds or clocks).

- Step 3** Click **Go**.

6.5 Go To Marker

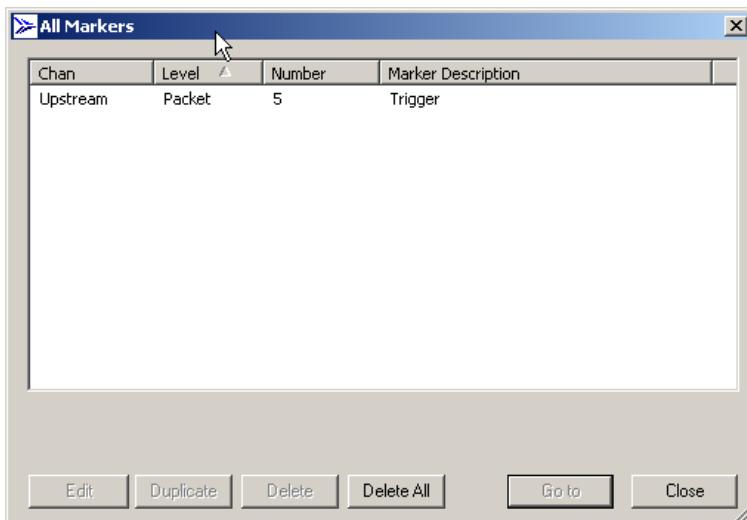
Use this operation to go directly to a specific packet that has been marked with a unique marker by the Set Marker operation.

To go to a marker:

- Step 1** Select **Go To Marker** from the Search Menu.

- Step 2** Select the marker you want from the fly-out menu.

Alternatively, select **All Markers** to display the All Markers window, then select a marker and click **Goto**.



The packet you want appears at the top of the screen. Marked packets have a red bar on the left edge.

6.6 Go To Menu

The **Go To menu** in the Search menu provides a quick way to search for a packet based on a simple condition. You can search for the following types of events:

- TLP Type
- DLLP Type
- Ordered Set
- Link Event
- Traffic Class
- DLLP Virtual Channel
- TLP Virtual Channel
- Direction
- Speed
- Link Width
- Requester ID
- Completer ID
- Data Lengths
- Errors

6.7 Search Direction

Search direction can be toggled back and forth by using the command under the Search menu. Search Direction controls the direction of the search. Each time Search Direction is selected, the search order is reversed. For example, if the previous search was **forward**, choosing **Search Direction** toggles the current search to **backward**.

To verify the direction of a search look at the lower right corner of the screen. **Search: Bwd** or **Search: Fwd** should appear. If a direction is not indicated, it means that the status bar is turned off.

To turn on the Status bar, select from the menu **View > Status Bar**.

Keyboard shortcuts can also be used to control search direction:

- **Control-f** means Search Forward.
- **Control-b** means Search Backward.

6.8 Find

Find allows you to conduct complex searches in a CATC Trace. You can search by protocol level (Packets, Link Transactions, Split Transactions).

You can search packets by Event Group: TLP Type, TLP Header, TLP Prefix (Summit T2-16 only), TLP Requester ID, TLP Completer ID, TLP Data Pattern, TLP Data Lengths, TLP Tag, TLP Sequence Number, DLLP Type, DLLP Header, DLLP Virtual Channel, ACK/NAK Seq Number, Ordered Sets, Link Event, Direction, Errors.

You can search link transactions by Event Group: TLP Type, Traffic Class, Virtual Channel, Direction, Requester ID, Completer ID, Status, Tag.

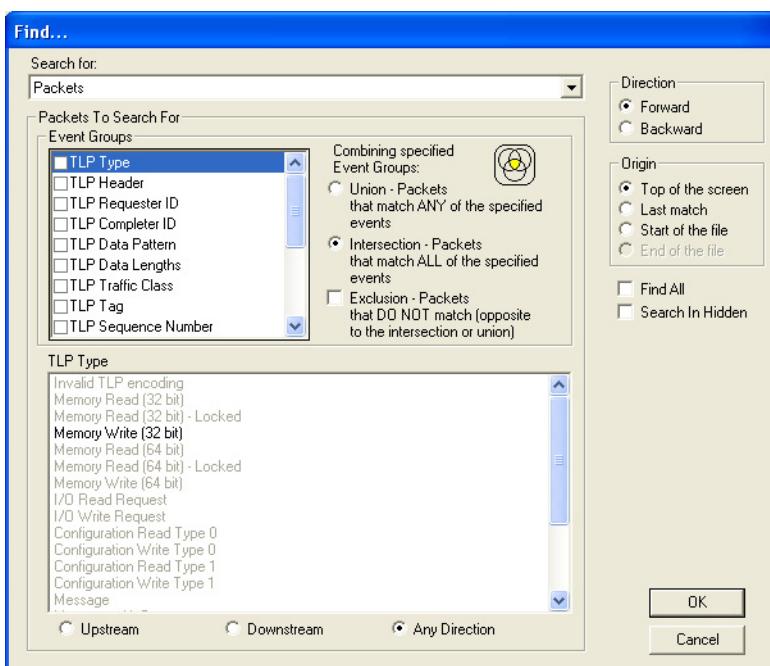
You can search split transactions by Event Group: TLP Type, Traffic Class, Virtual Channel, Direction, Requester ID, Completer ID, Status, Tag.

The options Union, Intersection, and Exclusion allow you to create complex searches such as "Find x OR y" or "Exclude all x or y."

To find a item:

Step 1 Open a CATC Trace.

Step 2 Open Find by selecting **Search > Find** from the menu or clicking .



Step 3 From the Search For menu, select a display level such as **Packets**. To search multiple levels, finish steps 3 to 9, and then repeat 3 to 9 for each additional display level.

Step 4 From the Event Groups menu, select an **Event Group**. The menu in the far right of the dialog box is context sensitive and changes to reflect the options for that group.

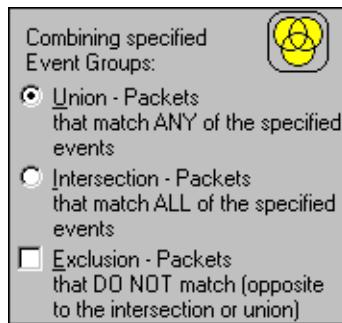
Step 5 In the menu in the far right, select one or more items.

Step 6 Repeat Step 5 for each Event Group of interest for the selected display level.

Step 7 Under Direction, select **Forward** or **Backward** to select a search direction.

Step 8 Under Origin, select a starting point for the search.

Step 9 Under **Combining Specified Event Groups**, select



The options Union, Intersection, and Exclusion let you set conditions on your searches:

- **Union:** To search for **any** of the selected criteria.
Example: "Find packets with ANY of the following characteristics ..."
- **Intersection:** To search for **all** of the selected criteria.
Example: "Find packets with ALL of the following characteristics ..."
- **Exclude:** To **exclude** items from a search. This option works in conjunction with Union and Intersection. You select Union and Exclude to exclude any of the specified traffic. You select Intersection and Exclude to exclude all of the specified traffic.
Example: "Exclude packets with ANY of the following ..." or
"Exclude packets with ALL of the following ..."

Step 10 Repeat Steps 3 through 9 for additional display levels.

Step 11 **Find All** displays all matching packets or transactions in a separate view.

Step 12 **Search in Hidden** includes hidden packets or transactions in the search.

Step 13 Click **OK**.

Event Groups

The Event Groups for Packets are:

- TLP Type
- TLP Header
- TLP Prefix (Summit T2-16 only)
- TLP Requester ID
- TLP Completer ID
- TLP Data Pattern
- TLP Data Lengths
- TLP Traffic Class
- TLP Tag
- TLP Sequence Number
- DLLP Type
- DLLP Header
- DLLP Virtual Channel
- ACK/NAK Seq Number
- Ordered Sets
- Link Event
- Direction
- Errors

The Event Groups for Link Transactions and Split Transactions are:

- TLP Type
- Traffic Class
- Virtual Channel
- Direction
- RequesterID
- CompleterID
- Status
- Tag

6.9 Search for the Next Packet Type

Use **Find Next** or click  to search for the next packet meeting the search criteria.

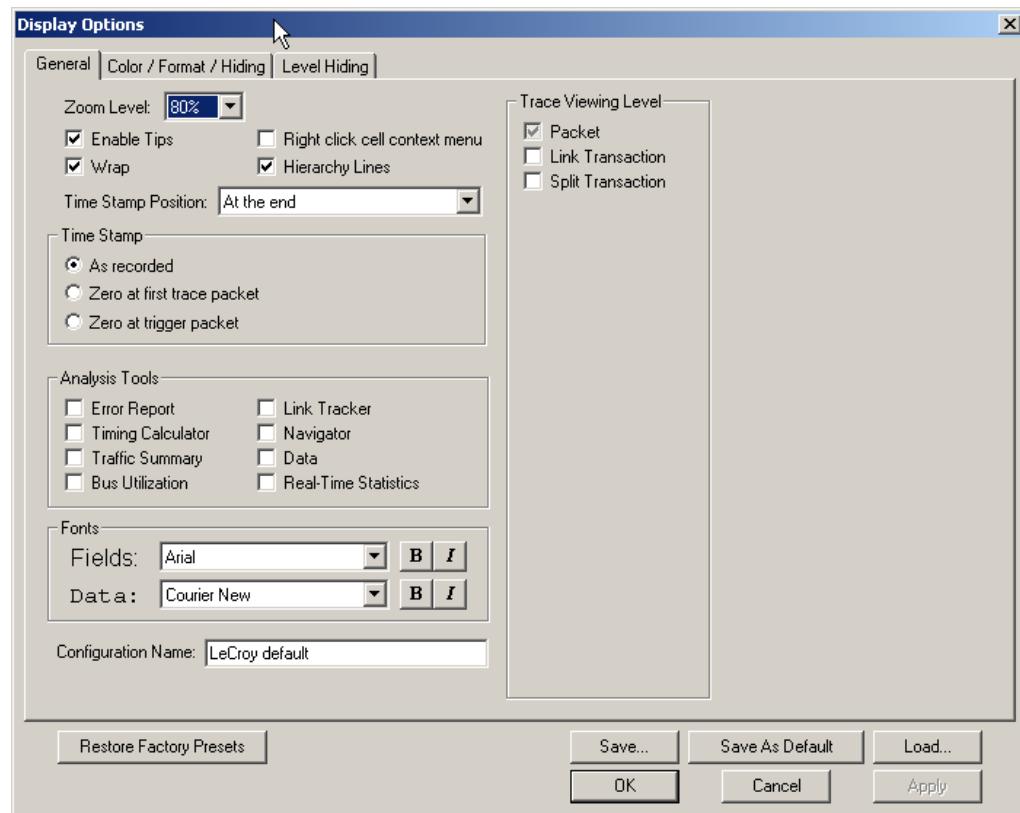
Chapter 7: Display Options

7.1 Setting Display Options

Display Options allow you to customize the colors and formats of displayed traffic.

To open the Display Options dialog at the General tab, Select **Setup > Display Options** from the menu or

click the **Display Options** button  on the toolbar.



7.2 Specifying General Display Options

The Display Options General tab allows you to specify:

Zoom Level: Defines the size of packet fields in the packet view. Zoom level is adjustable as 10, 20, 40, 60, 80, 100, 120, 140, 160, 180 and 200 percent.

Enable Tool tips: Allows information to be displayed on a packet by resting your mouse pointer over it.

Wrap: Allows packets, Link Transactions, and Split Transactions to wrap within the display.

Right click cell context menu: Swaps mouse functions.

Hierarchy Lines: Adds lines to the trace view indicating relations between packets, Link Transactions, and Split Transactions.

Timestamp position: Moves timestamp location from end of packet to beginning of packet, or merges it with the packet number.

Trace Viewing Level: Allows the CATC Trace to be displayed in different hierarchical levels: Packets, Link Transactions, and Split Transactions.

Time Stamp: Gives you options for setting the timestamp to zero for either the first CATC Trace packet or the trigger packet or for leaving the stamp unchanged as it was originally recorded.

Analysis Tools Checkboxes

Error Report: Opens Traffic Summary window and displays list of errors that occurred in the CATC Trace.

Timing Calculator: Opens Timing Calculator dialog for calculating timing between events.

Traffic Summary: Displays a table of events that occurred in the CATC Trace.

Bus Utilization: Opens a graph of bus usage in the open CATC Trace.

Link Tracker: Opens window that displays traffic on a per lane basis in a strictly chronological view.

Navigator: Displays/Hides Navigation bar. The Navigation bar lets you see in a glance the position of errors and triggers in a CATC Trace and narrow the range of traffic displayed in the CATC Trace window.

Data: Displays packet payload information in various formats.

Real-Time Statistics: Opens a dialog that displays a graph of bus activity on the DUT in real-time, as well as other statistical information.

Fonts

Fonts: Allows the appearance of field text and/or data text to be defined.

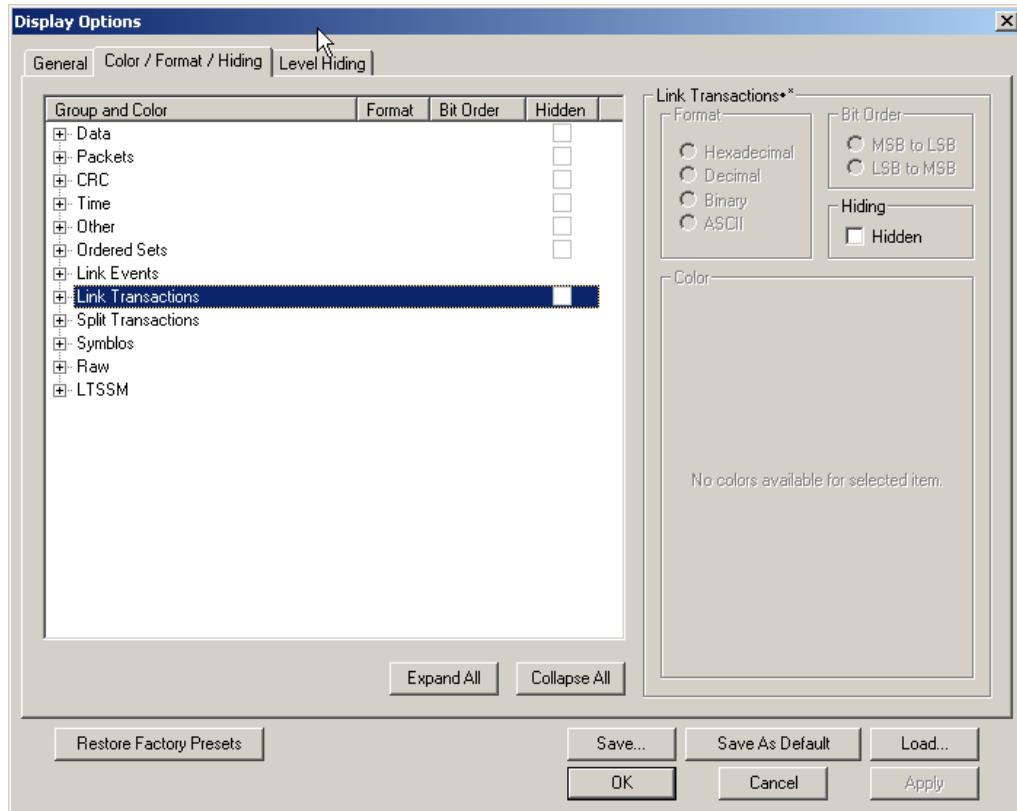
Configuration Name

Display Configuration Name: This field is used to enter a text string to be associated with the current set of Display Options. This name is saved with the Display Options file, and appears as part of the title of the packet view window that uses this set of Display Options.

7.3 Color, Format, and Hiding Options

The Color/Format/Hiding tab allows you to customize the colors and formats associated with each field in the CATC Trace and to selectively hide fields or packets. You access these display options by selecting **Setup > Display Options > Color/Format/Hiding** tab.

The Color/Format/Hiding property page lets you set how fields display in a CATC Trace. This property page lets you set field color and data format (binary, hex, decimal, ASCII), and lets you hide selected fields from the display.



Setting Field Colors

The Field Colors tab allows you to customize the colors associated with each field used in the packet view.

You may experiment with this option to achieve a color combination that suits you.

Select or change the trigger color using the color buttons labeled - **Packet #** and **+ Packet #** (before and after trigger) found under the **Packet#** section of the Field Colors window.

You select or change a color by clicking the appropriate color button. This action causes a color palette to pop up. Select the desired color and press OK.

Step 1 Click **View > Set Display Options** to open the Display Options dialog box.

Step 2 Select the **Color/Format/Hiding** property page.

Step 3 Under the Group and Colors column, click the **plus symbol (+)** next to the group you want to reformat. The group expands to show the individual fields within the group. Each field has a color, as shown below:

Group and Color	Format	Bit Order	Hidden
[-] Data			<input type="checkbox"/>
[-] Packet Data	Hex	MSB to LSB	<input type="checkbox"/>
[-] Data Length	Dec		<input type="checkbox"/>
[-] External Data	Bin		<input type="checkbox"/>
[-] Cfg Data	Hex		<input type="checkbox"/>
[-] Invalid packet	Hex	MSB to LSB	<input type="checkbox"/>
[-] Raw Data			<input type="checkbox"/>
[+] Packets			<input type="checkbox"/>
[+] CRC			<input type="checkbox"/>

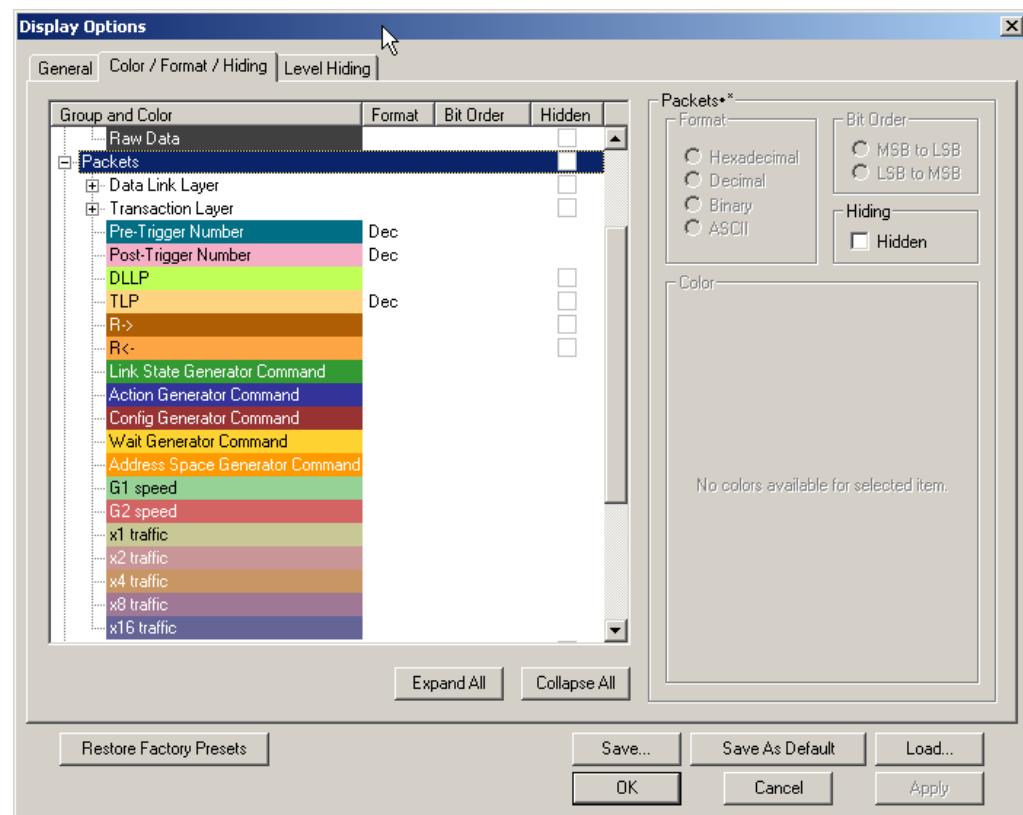
Step 4 Click the colored cell that you want to change. A color palette appears.

Step 5 Click a color in the palette, then click **Apply** or **OK**.

Note: The colors of the following Frame types cannot be changed:

- Invalid Data (frame error) field (**red**)
- Softbit Errors (**yellow**)

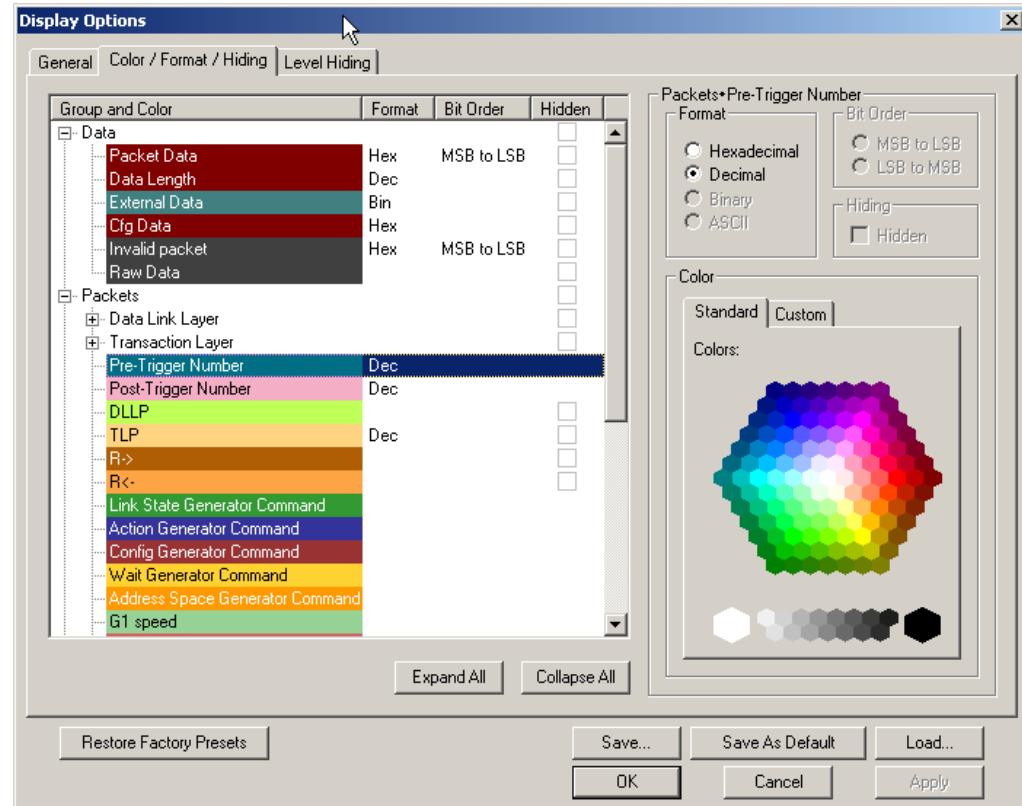
You can also change color by left-clicking a field in the CATC Trace and selecting Color from the pop-up menu.



Changing Field Formats

The Field Formats tab allows you to define the way various numeric fields are shown in the packet display. You can select Hexadecimal, Decimal, Binary, or ASCII for certain fields or groups of fields.

To change a field's format, click the plus sign (+) next to a field in the list. This causes the selected item to expand so you can see its constituent sub-fields. Select a sub-field, and then choose the format from the formatting choices that appear at the bottom of the window.



To change the format of alphanumeric characters in a field:

Step 1 Under the Group and Colors column, click the **plus** symbol (+) next to the group you want to reformat. The group expands to show the individual fields within the group (as shown above).

Step 2 Click the **row** representing the field that you want to reformat. If the field can be reformatted, the format options at the top of the dialog box become active, as shown below:



Step 3 Select a **format**.

Step 4 Specify the bit order in the displayed fields by checking/unchecking the **MSB > LSB** checkboxes.

Step 5 Click **Apply** or **OK**.

Hiding Fields

To hide a field:

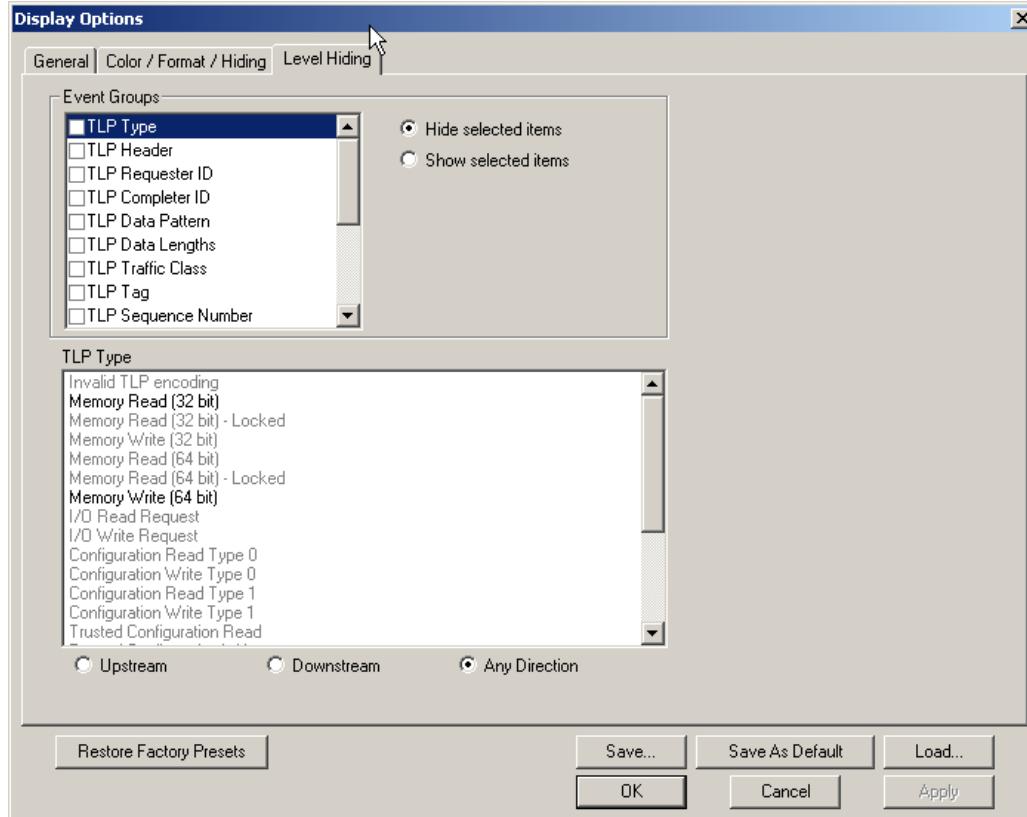
Step 1 Under the Group and Colors column, click the **plus** symbol (+) next to the group that has the field(s) you want to hide. The group expands to show the individual fields within the group (as shown above).

Step 2 Click the **checkbox** in the row representing the field that you want to hide.

Step 3 Click **Apply** or **OK**.

Hiding Levels

The Level Hiding page lets you hide traffic by Event Group. If you select one or more event types from the Event Group list, the selected types are hidden from the CATC Trace.



To hide a level:

- Step 1** Select an Event Group.
- Step 2** Select whether to **Hide** or **Show selected items**.
- Step 3** Select **Upstream**, **Downstream**, or **Any Direction**.
- Step 4** (optional) Select **Compact EIEOS packets**.
- Step 5** Click **OK**.

The Event Groups for Packets are:

- TLP Type
- TLP Header
- TLP Requester ID
- TLP Completer ID
- TLP Data Pattern
- TLP Data Lengths
- TLP Traffic Class
- TLP Tag
- TLP Sequence Number
- DLLP Type
- DLLP Header
- DLLP Virtual Channel
- ACK/NAK Seq Number
- Ordered Sets
- Link Event
- Direction
- Errors

The Event Groups for Link Transactions and Split Transactions are:

- TLP Type
- Traffic Class
- Virtual Channel
- Direction
- RequesterID
- CompleterID
- Status
- Tag

7.4 Load a Previously Saved Display Options File

If you have previously saved Display Options, you can load them by opening the Display Options dialog and clicking the **Load** button. A dialog box opens to let you load a previously saved display options file.

Step 1 Click **Load** to use a previously defined display options file.

Step 2 When you see the Open File pop-up window, enter the name of the file you want to load and click **Open**.

Step 3 When the PETracer™ software returns you to the Recording Options menu, click **OK** to activate the display options you selected.

7.5 Saving Display Options

If you have customized the Display Options and wish to save them, you can do so by clicking the **Save** button, then entering a unique file name. The **.opt** extension is added by default.

Setting the Defaults: Save the currently specified Display Options to the file name: **default.opt** by clicking **Save As Default**. When the Analyzer software begins execution, it automatically loads the **default.opt** file, if one exists.

Chapter 8: Recording Options

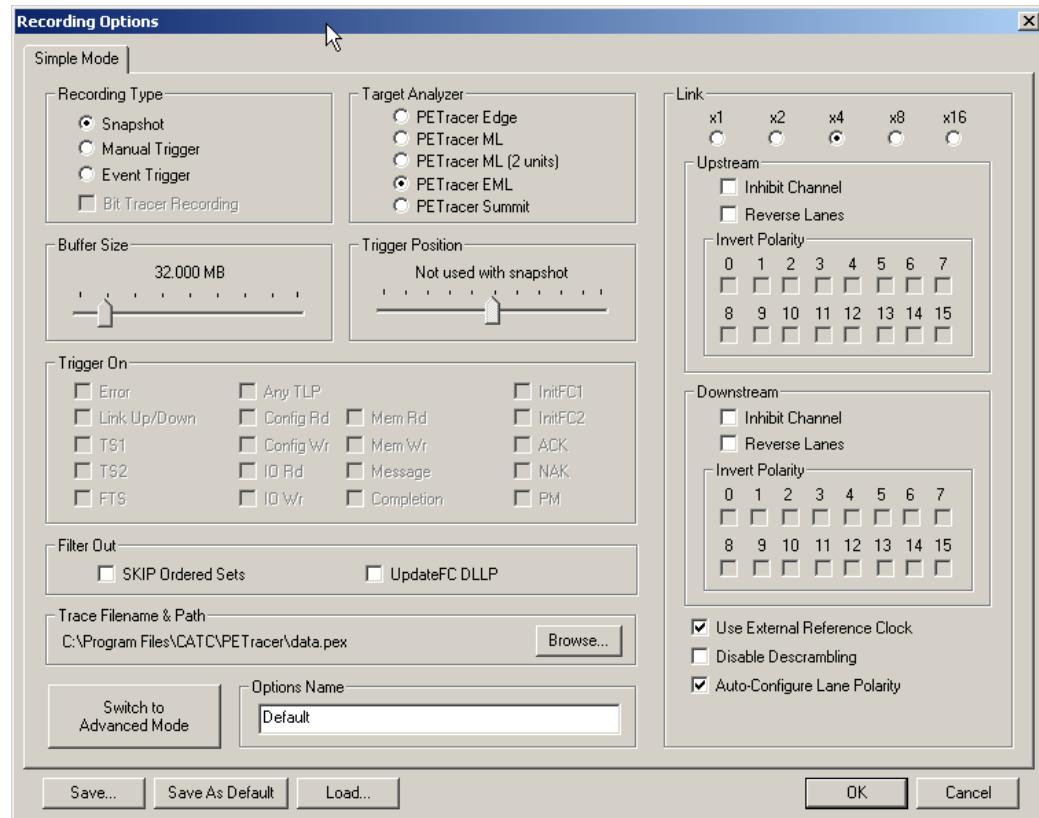
8.1 Setting Recording Options

The Recording Options dialog is used to configure a recording.

To open the Recording Options window, click  or select the command **Setup > Recording Options**.

Note: There are separate sets of Recording Options for each Analyzer type. To set the Analyzer type, select the appropriate platform from the Target Analyzer menu in the General page of the Recording Options.

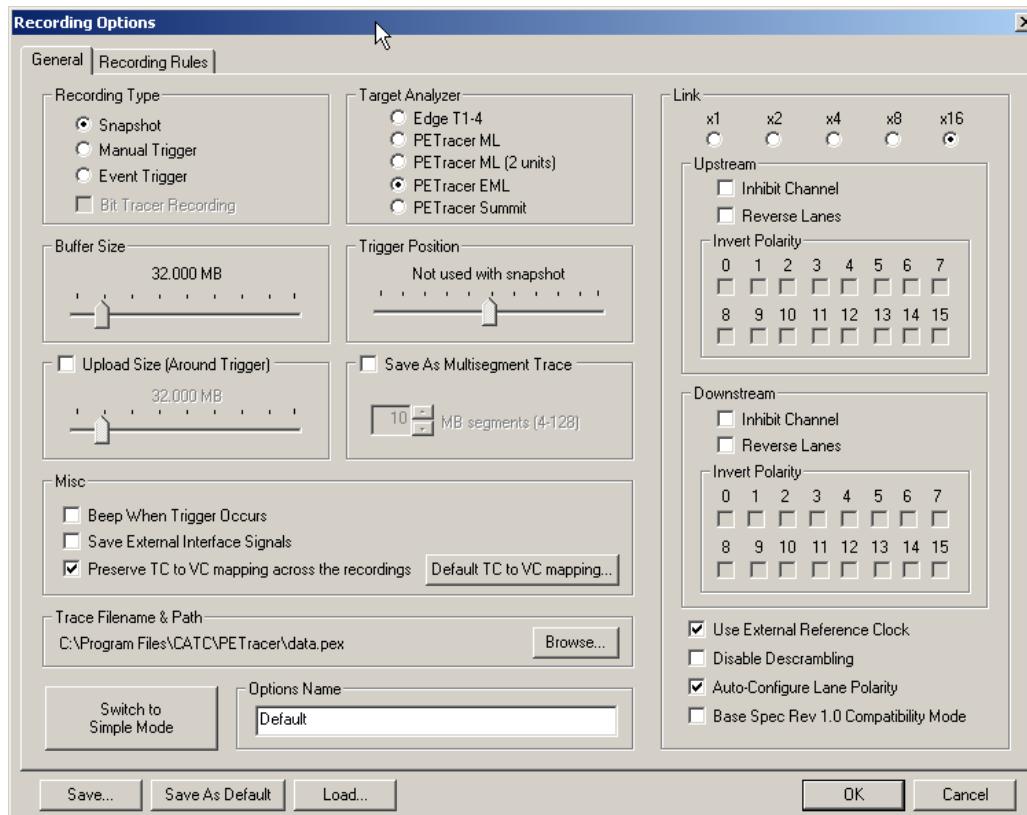
Figure 1: PETracer EML in Simple Mode:



8.2 General Tab

The General Page presents options that affect all recordings:

PETracer EML in Advanced Mode:



Recording Type: Sets the trigger mechanism for the recording: Snapshot, Manual Trigger, and Event Trigger.

Target Analyzer: Presents a menu with options for selecting an Analyzer platform:

- PETracer Edge
- PETracer ML
- PETracer ML (2 Units)
- PETracer EML
- PETracer Summit
- Summit T2-16

Buffer Size: Causes the Analyzer to record traffic to its buffer and then upload the CATC Trace to the host PC. Recordings are limited in size to the size of the Analyzer's buffer (4 GB per direction).

Trigger Position: Controls the percentage of buffer allocated for pre- and post-buffer recording.

Trigger On (Simple Mode): Error, Link Up/Link Down, TS1, TS2, FTS, Any TLP, Config Rd, Config Wr, IO Rd, IO Wr, Mem Rd, Mem Wr, Message, Completion, InitFC1, InitFC2, ACK, NAK, and/or PM.

Filter Out (Simple Mode): SKIP Ordered Sets and/or UpdateFC DLLP are provided.

Trace Filename & Path: Sets the path and CATC Trace name for the recording.

Options Name: Sets a descriptive label for the Recording Options so you can more easily recall what settings are in the Recording Options file.

Link: Settings: For link width, inhibiting recording, polarity, external reference clock, swapping recording channels, inverting link polarity, and descrambling.

Upload Size (Advanced Mode): Causes the Analyzer to upload a portion of the Analyzer's buffer. This option lets you look at part of the CATC Trace. Half of the uploaded CATC Trace is pre-buffer and half post-trigger.

Save As MultiSegment Trace (Advanced Mode): Divides the recording into segments so as to make very large recordings more easily uploaded and viewed. If you are planning to create a large recording, you might want to test this option to see how it affects performance. Large CATC Trace files are easier to navigate but slower to open.

Misc (Advanced Mode): Turns on trigger beep, sets external clocking (EML only), allows external interface signals to be saved into the CATC Trace, and tells the Analyzer to use whatever TC to VC mapping was used in the last recording (to re-use previously discovered Configuration Space data) in all future recordings. Also presents a button for manually mapping the Traffic Classes to Virtual Channels.

Recording Type

Recording Type lets you to specify the type of recording you want to make:

- **Snapshot:** A recording of a pre-determined length. You set the recording length in the Buffer Size box. Recording begins when you click the **Rec** button on the toolbar and ends when the selected buffer size is filled or when you press the **Stop** button.
- **Manual Trigger:** A recording that switches between the pre-trigger buffer and the post-trigger buffer when you push the **Trigger** button on the front of the Analyzer. Recording begins when you select **Start** in the application. Pressing the **Trigger** button causes the Analyzer to begin to finish recording. Recording continues until the post-trigger buffer has been filled. You can also end the recording by pressing the **Stop** button in the application.
- **Event Trigger:** A recording that switches between the pre-trigger buffer and the post-trigger buffer when it is triggered by an event in the CATC Trace. An Event Trigger begins when you select **Start** in the application and ends when the specified triggering event occurs in the CATC Trace or you press **Stop**. If an event triggers the end of the recording, the Analyzer records a predefined amount of post-trigger data (specified by Trigger Position and Buffer Size.)

Note: You can also terminate an Event Trigger recording by pressing the Manual Trigger button on the front of the Analyzer. When the Manual Trigger button is pressed, the Analyzer continues to record until the specified post-trigger buffer has been filled.

Buffer Size

The Buffer Size slide-bar allows you to set the size of the recording buffer.



Note: Size selection is per direction. For example, selecting 32 MB creates two memory areas of that size.

After you have set the Buffer Size, you must set the Recording type and Trigger position options. These options determine how the buffer is used.

Note: The Buffer Size slide-bar does not precisely portray the buffer size because of the way the packets are stored in the Analyzer's memory.

Target Analyzer

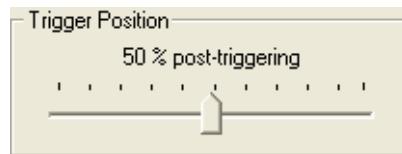
Target Analyzer presents a menu with these choices:

- **PETracer Edge**: Displays the options for the PETracer Edge Analyzer.
- **PETracer ML**: Displays the options for the PETracer ML Analyzer.
- **PETracer ML (2 Units)**: Displays the same options as PETracer ML but lists **Unit 1** and **Unit 2** in the Link Section on the right. In a two-unit setup, **Unit 1** and **Unit 2** are two separate Analyzers linked together by BNC on the back of the units to form a single, logical Analyzer.
- **PETracer EML**: Displays the options for the PETracer EML Analyzer.
- **PETracer Summit and Summit T2-16**: Displays the options for the PETracer Summit or Summit T2-16 Analyzer.

Selecting an Analyzer platform changes the options presented in the Link and Events pages within the Recording Options dialog.

Trigger Position

This Trigger Position slide-bar lets you to adjust the amount of recording buffer allocated to recording pre-trigger and post-trigger traffic.



For example, if you set the Trigger Position to 90% Post-Triggering Traffic, the Analyzer records 10% pre-trigger traffic and 90% post-trigger traffic.

Trigger Position is only available when Manual Trigger or Event Trigger is selected.

Trigger On

In Simple Mode (see Figure 1), Trigger On allows you to select: Error, Link Up/Link Down, TS1, TS2, FTS, Any TLP, Config Rd, Config Wr, IO Rd, IO Wr, Mem Rd, Mem Wr, Message, Completion, InitFC1, InitFC2, ACK, NAK, and/or PM.

Trace Filename and Path

The Trace Filename and Path button on the Recording Options General panel allows you to change the default file name and path for the recorded CATC Trace file. The pre-defined name is **data.pem**.

Step 1 Select the **Recording File Name** button.

Step 2 When you see the **Save As** menu, navigate to the directory you want.

Step 3 Enter the new file name in the File name field.

Step 4 Click the **Save** button.

This action does not do any immediate save operation. It just changes the default name and uses it in subsequent recordings.

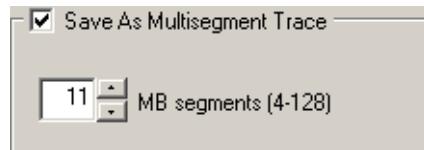
Options Name

The Options Name is a descriptive, supplemental label that you can assign to a Recording Options file.

For example, if your Recording Options file were named **StandardSettings.rec**, your Options Name could be a long descriptive label such as **Standard Record Options used for all normal Recordings**.

Save As MultiSegment Trace

This option causes the Analyzer to segment the CATC Trace into 4 MB to 128 MB files and to create an index file that summarizes the starting and finishing frame for each segment.



The index file has a default name of **data.pem**.

The index file and segmented CATC Trace files are stored in a directory named **data_pem_files**. The directory is named after the index file. Below this directory additional, sequentially numbered sub-directories (up to 10,000) hold the segmented CATC Trace files. These sub-directories bear simple numerical names: 00000 to 00999. Each of these subdirectories can hold up to 100 sequentially numbered segment files.

Example

A 1010 MB recording using the default file names creates the following sub-directories and files:

```
data.pem (This is the index file.)  
data_pem_files\00000\segment_00000.pex  
data_pem_files\00000\segment_00001.pex  
...  
data_pem_files\00000\segment_00099.pex  
data_pem_files\00001\segment_00100.pex  
data_pem_files\00001\segment_00101.pex
```

The index file looks something like a CATC Trace file but contains packet-like entities that summarize each segment.

Viewing Multisegmented Files

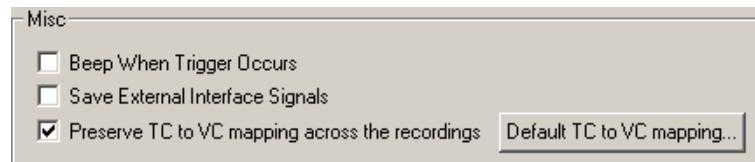
If Save As MultiSegment Trace is enabled in the General page of the Recording Options, PETracer divides the CATC Trace into segments and stores them on the host's hard drive. Segment size is set in the MB Segments box. Enter a value from 4 MB to 128 MB.

PETracer also creates an index file that provides a brief summary of each segment and hyperlinks to each of the segments. Double-clicking a segment summary in the index file causes PETracer to open that segment.

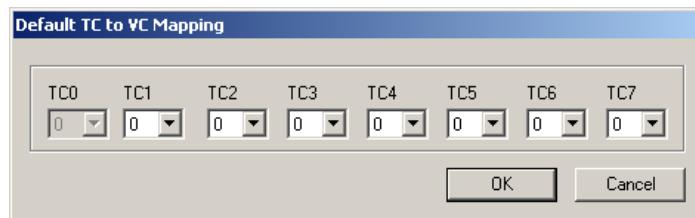
You can also navigate through the segments by clicking the buttons on the Multisegment toolbar.

Misc

Allows you to specify the following parameters for recording and uploading traffic:

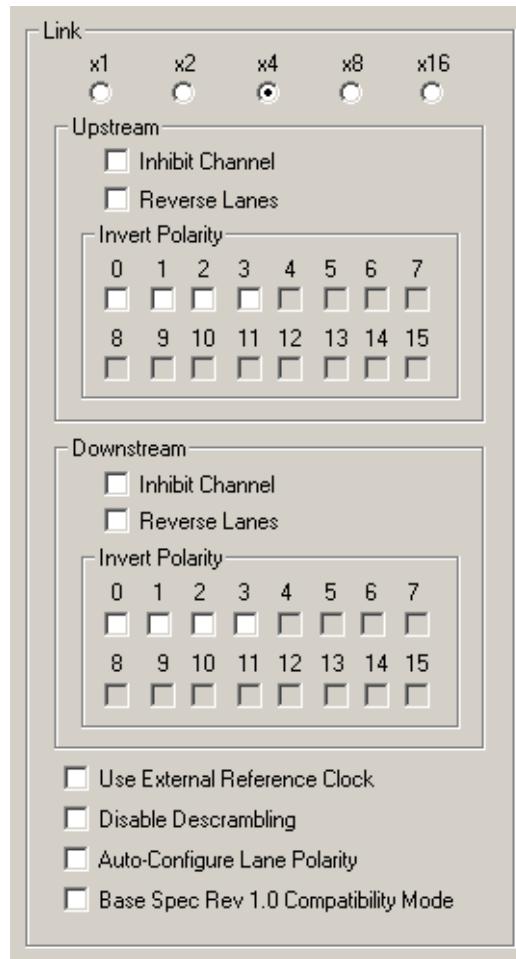


- **Beep When Trigger Occurs:** Causes the Analyzer to beep when a trigger event is detected.
- **Save External Interface Signals:** If selected, causes the Analyzer to save signals from a Breakout Board as fields in the CATC Trace.
- **Preserve TC to VC mapping across the channels:** Causes the Analyzer to use whatever TC to VC mapping it established in the last recording.
- **Default TC to VC mapping button:** Lets users manually configure the default mapping.



Link for PETrainer EML

The Link section allows you to manage links:



Link Width: Sets the physical width of the link.

Upstream and Downstream: Gives you low-level control over each link direction. The heading for these boxes indicates the port and/or unit to which the following options are applied based on the current Analyzer configuration:

- **Inhibit Channel:** See above.
- **Reverse Lanes:** See above.
- **Invert Polarity:** See above.

Use External Reference Clock: If the PCI Express link under analysis uses spread-spectrum clocking, then the Analyzer must use the external reference clock from the host system. If host does not supply a reference clock, the internal reference clock in the Analyzer module is used instead for link analysis.

Disable Descrambling: If checked, causes the Analyzer to assume that none of the PCI Express traffic is scrambled. By default, the Analyzer determines the scrambling state of the devices under test.

Auto-Configure Lane Polarity: Lets the Analyzer determine lane polarity.

Base Spec 1.0 Rev Compatibility Mode (Advanced Mode): This option causes the Analyzer to conform to the PCI Express 1.0 Specification.

Saving and Loading Previously Saved Recording Options

The options are:

Save: Saves the current options to whatever file name you provide.

Save As Default: Saves the current options into the default options file. This file is called **default.rec** or whatever other name you have assigned to the default options file. Whenever the LeCroy PETracer software begins execution, it automatically loads the default file, if one exists.

Load: Loads a previously saved set of recording options.

OK: Applies changes and closes the Recording Options dialog box.

Cancel: Cancels changes and closes the Recording Options dialog box.

Loading Recording Options

In the Recording Options menu, you can load a previously saved recording options file.

To load Recording Options:

Step 1 Select **Setup > Recording Options** from the menu.

Step 2 Click the **Load** button from the Recording Options dialog box. The Load dialog opens and lists previously saved options files (*.rec).

Step 3 Select a file and click **OK**. The options file loads.

Saving Recording Options

Recording Options settings can be saved and later reused. Recording options settings are stored in *.rec files.

Step 1 Open the Recording Options dialog by selecting **Setup > Recording Options**.

Step 2 Set your options, then click **Save**.

Step 3 Enter a unique file name. The .rec extension is added by default.

Step 4 (optional) To add a descriptive label to this file to help you remember what options were set, use the **Options Name** box.

Setting Default Recording Options

To save the current recording options into the default Recording Options file:

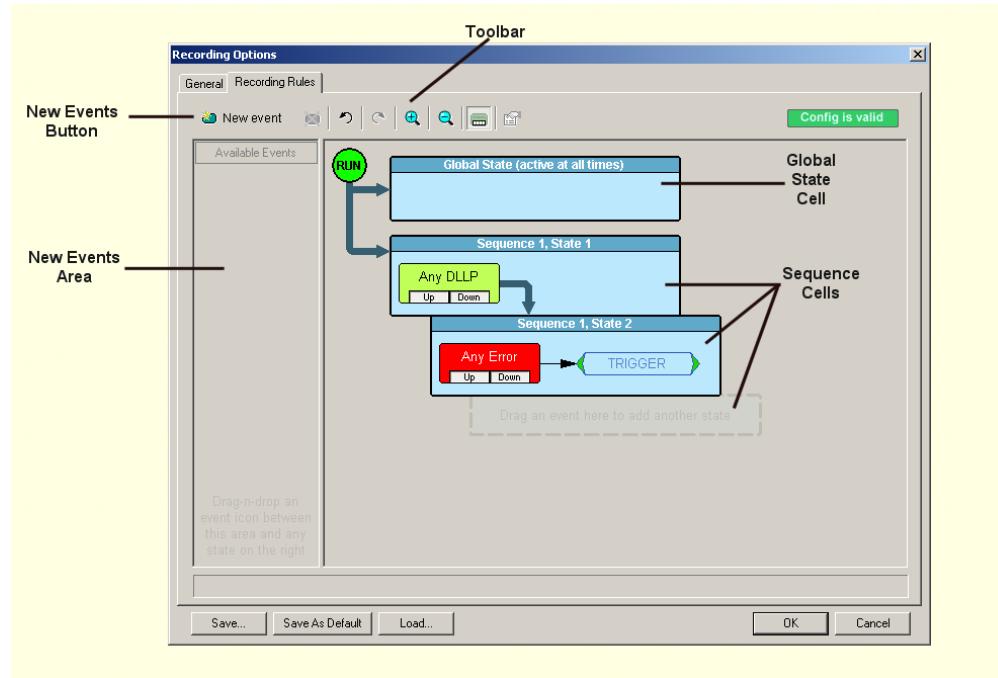
- Click **Save As Default**.

The default file for the options is **default.rec**.

When the PETracer software begins execution, it automatically loads the **default.rec** file, if one exists.

8.3 Recording Rules Overview

The Recording Rules page lets you set triggers and filters.



The page divides into three areas:

Toolbar: Contains buttons such as the New Events button for issuing commands.

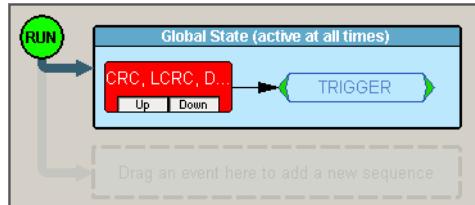
Available Events area: A part of the screen where you can park buttons that you intend to use in the Main display area.

Main display area: The part of the screen where you create trigger and filter conditions. You create conditions by dragging buttons onto the Main display area from the Available Events area. You then create additional conditions by right-clicking a button and selecting options from a pop-up menu. See Creating Recording Rules.

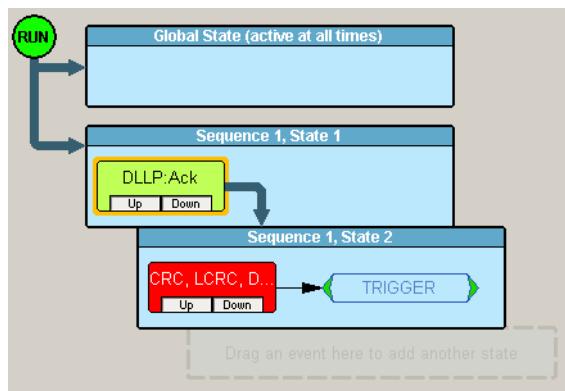
Global State vs. Sequences

The Main Display area in the center of the Recording Rules page has two cells that affect events differently.

Global State: Events dragged into the Global State cell are searched for throughout the recording. For example, if you place an Error in the Global State cell and assign a Trigger to it, the Analyzer searches for errors from the start of the recording until the end.



Sequence State: The cell marked **Drag an event here to create a new sequence** is a Sequence Cell. Sequence cells are used to event sequences, which are chains of events culminating in a trigger or other action. One sequence (i.e., a separate chain of events) can be created with up to 32 states. A state is an event condition plus some action within a sequence.



8.4 Recording Rules Buttons

The Recording Rules toolbar allows you to create and edit recording rules:



	New Event. Opens a drop-down menu with a list of events.		Zoom in
	Delete. Delete selected event.		Zoom out
	Undo. Undoes last action.		Show/Hide Channels. Shows/hides the channel buttons.
	Redo. Undoes last Undo command.		Show properties. Opens the Properties dialog box for the selected item.

8.5 Creating Recording Rules

The Recording Rules page is used to set triggers and filters. To access this page, select **Setup > Recording Options > Recording Rules**.

There are three steps to creating a recording rule:

- 1) Select events.
- 2) Place the events in the Global State or Sequence cells.
- 3) Assign actions to the events.

Note: There are limits to the types of rules that can be created. See “Recording Rule Limits” on page 115 for details.

- Step 1** Click  **New event** and select one or more events from the menu. Selecting an event automatically places it in the Available Events area. This area serves as a parking lot where you can place event buttons without them having any effect on the Analyzer.



- Step 2** Drag the selected events from the Available Events area into one of either the Global State cell or the Sequence cell (see “Global State vs. Sequences” on page 111):

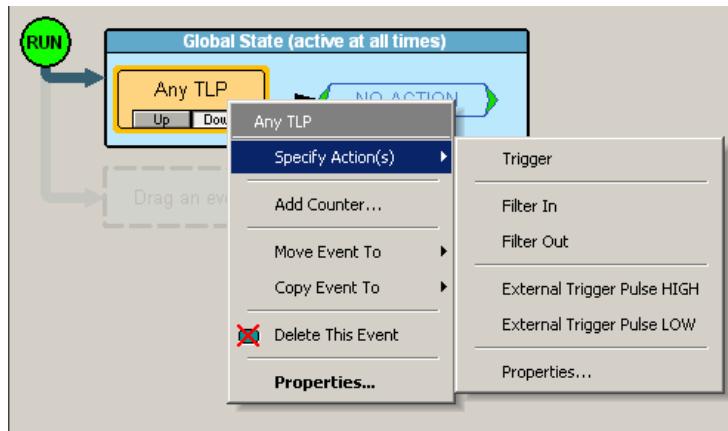


Global State Cell: If you want the Analyzer to always search for the event, place it in the cell marked **Global State**.

Sequence Cell: To create an event sequence, place two or more events in the faintly marked cell that reads **Drag an event here to create a sequence**. At this point, the selected events have no effect because an action has not been assigned.

- Step 3** To select a sub-set of your selected event, right-click it and choose **Properties**. A Properties dialog box opens that presents additional options. For example, if you open the Properties dialog for Errors, you can set the specific types of errors the Analyzer should look for.

Step 4 Assign an action to the selected events by right-clicking each of the events, selecting **Specify Action** from the pop-up menu, and assigning an action such as **Trigger**, **Filter**, or **Count**. Be sure to click the event itself and not the **State** cell that it is sitting in (which produces a different pop-up menu.)



Note: You can also assign actions to events by double-clicking the event and selecting the Actions page when the Properties dialog box opens.

Step 5 Click **OK** to close the dialog box. At this point, assuming that the other options in the Recording Options dialog box have been set (such as the General page), you can begin the recording by pressing the

Start Recording button.

8.6 Recording Rule Limits

PETracer EML has finite buffer resources that limit the number of actions and events that can be assigned for each recording channel. When creating complex event sequences, it is possible to hit the limits of these resources and get an error message like the ones shown in the screenshots below.

In addition to the following limitations, you should also be aware of how PETracer handles user-created contradictory rules. See “Recording Rules Logic: How Contradictory Rules are Resolved” on page 116 for an explanation.

In order to maximize the buffer allocation for recordings, LeCroy has imposed the following configuration limitations into PETracer EML.

Configuration Limitations in PETracer EML

- **Four actions per state per channel:** See example above.
- **Two Link Condition/ Ordered Set resources per channel:** See example above.
- **Up to four different DLLPs per channel**
- **Up to three different TLPs per channel**
- **One error set per channel**
- **Four payload DWORD-checkers per channel**
- **Two Timers per channel**
- **Two counters per channel:** No cross channel counting.

8.7 Recording Rules Logic: How Contradictory Rules are Resolved

When creating rules in the Recording Rules page, it is possible to create contradictory instructions such **Filter Anything Out** and **Filter Anything In**. To resolve such conflicts, the Recording Rules page implements three internal rules that are described here:

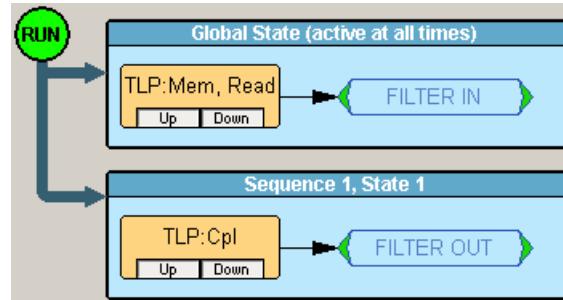
- Rules created in Sequence cells have a higher priority than rules created in the Global State cell: If a rule is placed in a Sequence cell, and a contradictory rule is placed in Global State cell, the rule in the Sequence cell applies.
- Filter-In has a higher priority than Filter-Out, so when a Filter-In rule is placed inside the same state as Filter-Out rules, only the Filter-In rule applies.
- Filter-In Anything and Filter-Out Anything have the highest priority and override any other filtering rules, so when Filter-In Anything or Filter-Out Anything are placed in the same state cell as other Filter rules, only the Filter-In Anything or Filter-Out Anything rules apply.

Recording Rules Examples

Read through the following examples to better understand how the three rules apply.

Note: In addition to these three rules, the Recording Rule Limitations define the **upper limits** of rule creation. These limitations should not affect you, but you should be aware of them.

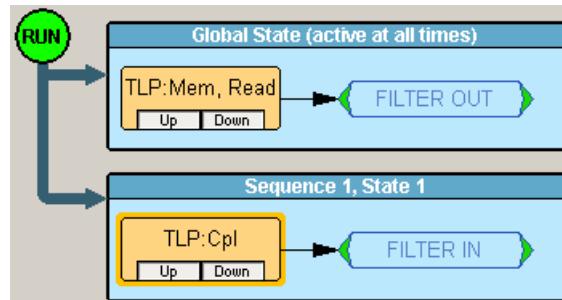
Example 1



Result: Only TLP:Mem,Read is in the CATC Trace.

Reason: The Sequence rule Filter out TLP:Completion is not contradicting the global state rule to filter in TLP:Memory. Both rules are applied.

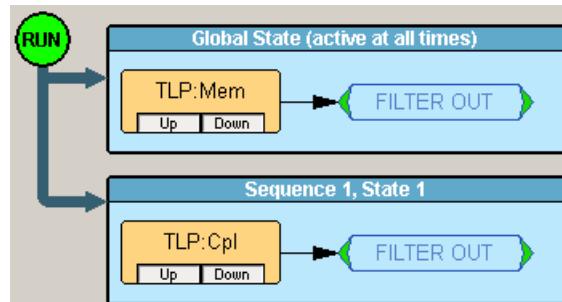
Example 2



Result: Only TLP:Completion is in the CATC Trace.

Reason: The sequence rule to filter in TLP:Completion is not contradicting the global state rule to filter out TLP:Memory. Both rules are applied.

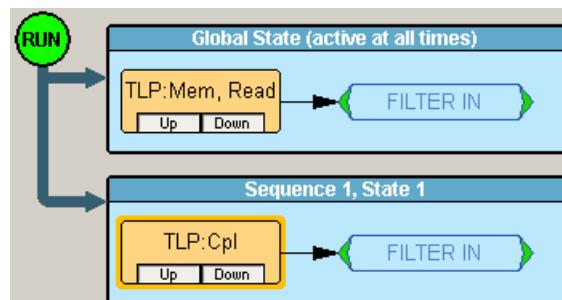
Example 3



Result: TLP:Completion and TLP:Memory are filtered out.

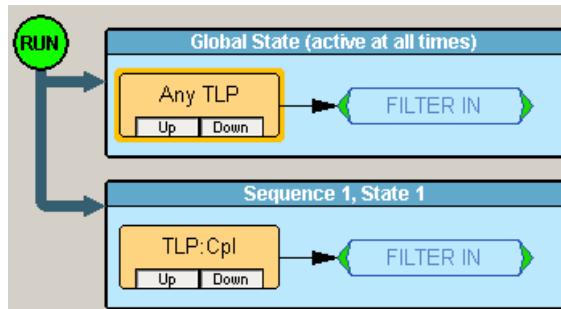
Reason: The Sequence rule to filter out TLP:Completion is not contradicting the global state rule to filter out TLP:Memory. Both rules are applied.

Example 4



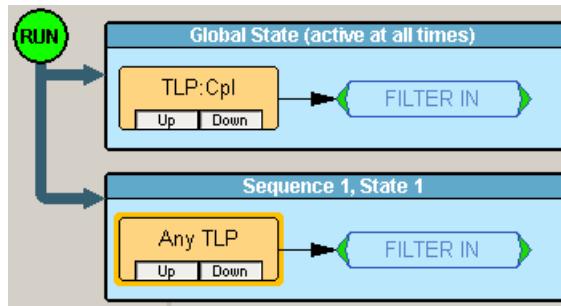
Result: Only TLP:Completion and TLP:Memory are in the CATC Trace.

Reason: The sequence rule to filter in TLP:Completion is not contradicting the global state rule to filter in TLP:Memory. Both rules are applied.

Example 5

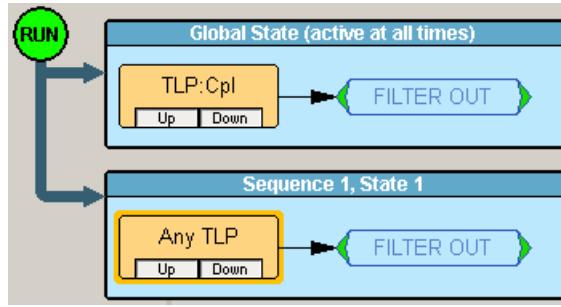
Result: Only TLP (any type) is in the CATC Trace.

Reason: The sequence rule to filter in TLP:Completion is not contradicting the global state rule to filter in Any TLP. Both rules are applied.

Example 6

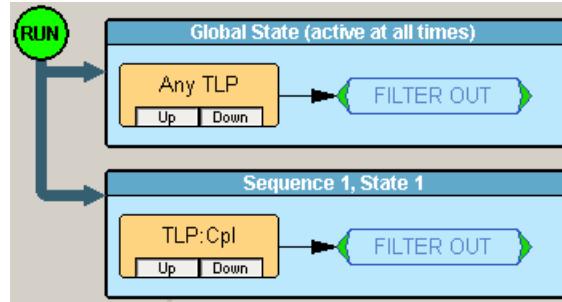
Result: Only TLP (any type) is in the CATC Trace.

Reason: The sequence rule to filter in Any TLP is not contradicting the global state rule to filter in TLP:Completion. Both rules are applied.

Example 7

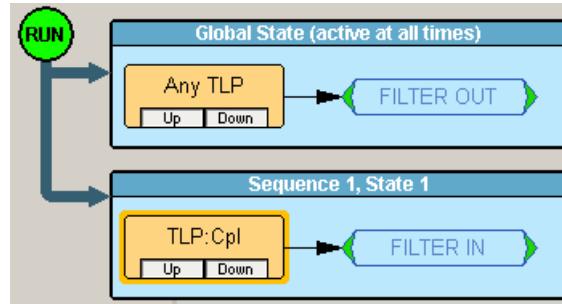
Result: All TLP are filtered out.

Reason: The sequence rule to filter out Any TLP is not contradicting the global state rule to filter out TLP:Completion. Both rules are applied.

Example 8

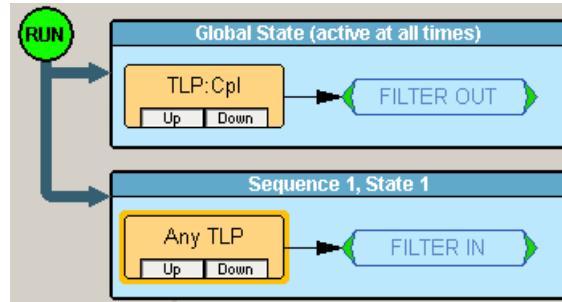
Result: All TLP are filtered out.

Reason: The sequence rule to filter out TLP:Completion is not contradicting the global state rule to filter out Any TLP. Both rules are applied.

Example 9

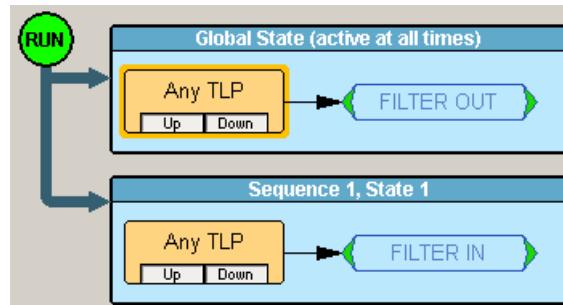
Result: Only TLP:Completion is in the CATC Trace.

Reason: The sequence rule to filter in TLP:Completion is overwriting the global state rule to filter out Any TLP.

Example 10

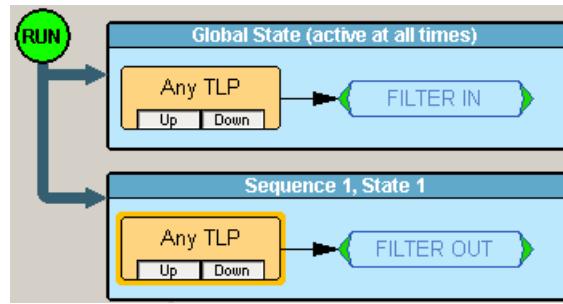
Result: Only TLP (any type) is in the CATC Trace.

Reason: The sequence rule to filter in Any TLP is overwriting the global state rule to filter out TLP:Completion.

Example 11

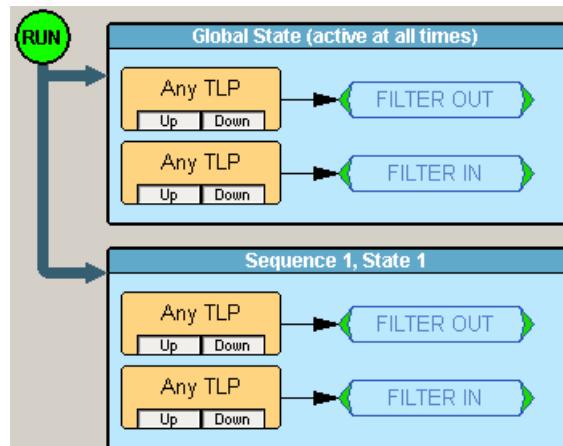
Result: Only TLP (any type) is in the CATC Trace.

Reason: The sequence rule to filter in Any TLP is overwriting the global state rule to filter out Any TLP.

Example 12

Result: Empty CATC Trace.

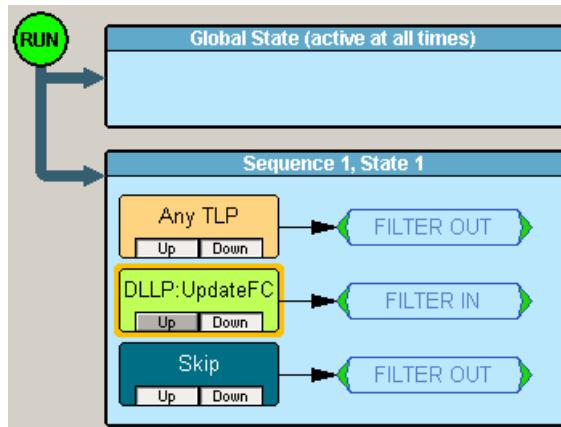
Reason: The sequence rule to filter out Any TLP is not contradicting the global state rule to filter in Any TLP. Both rules are applied. (The global rule filters out DLLPs and Ordered Sets, and the sequence rule filters out TLPs.)

Example 13

Result: Only TLP (any type) is in the CATC Trace.

Reason: Filter out rules in the global state cell and in the sequence state cell are ignored. The Filter-In Any TLP rule is used.

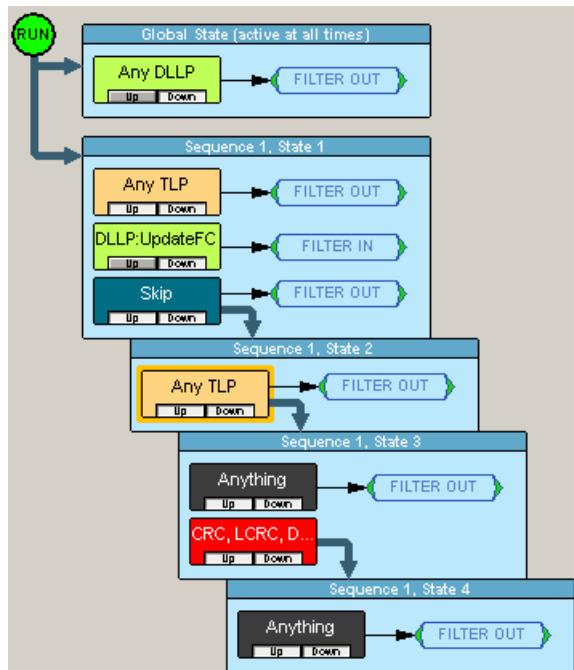
Example 14



Result: Only DLLP:UpdateFC is in the CATC Trace.

Reason: The Filter out rules are ignored. Filter in DLLP:updateFC rule is used.

Example 15



While in state 1: Only DLLP:UpdateFC is in the CATC Trace.

Reason: The Filter out rules are ignored. Filter in DLLP:updateFC rule is used.

While in state 2: Only Ordered Sets are in the CATC Trace.

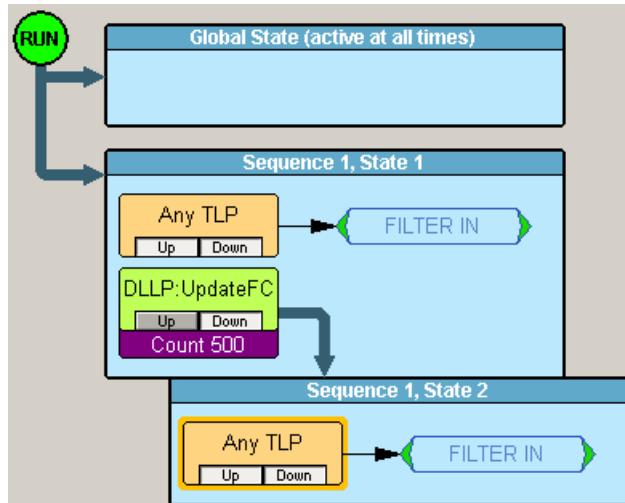
Reason: Both the sequence state and the global state rules are used, and all TLPs and DLLPs are filtered out.

While in state 3: Nothing is recorded.

While in state 4: Everything is recorded.

Reason: The sequence state rule to filter in anything overwrites global state rule.

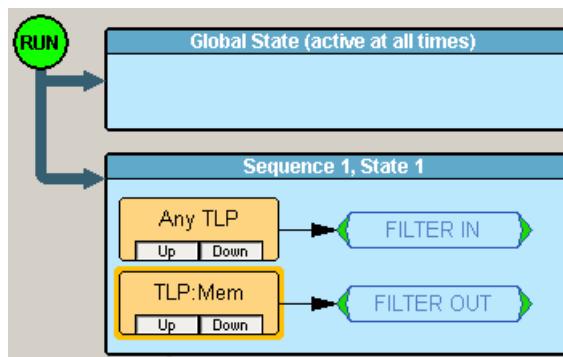
Example 16



Result: Only TLP (any type) is in the CATC Trace.

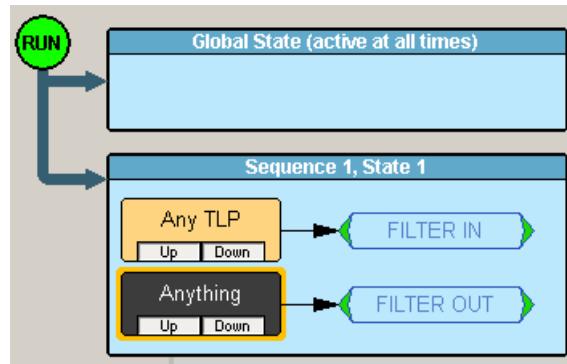
Reason: In both states, the rule is to keep only TLP.

Example 17



Result: Only TLP (any type) is in the CATC Trace.

Reason: The Filter-out rule is ignored because there is a filter-in rule with a higher priority.

Example 18

Result: Empty CATC Trace.

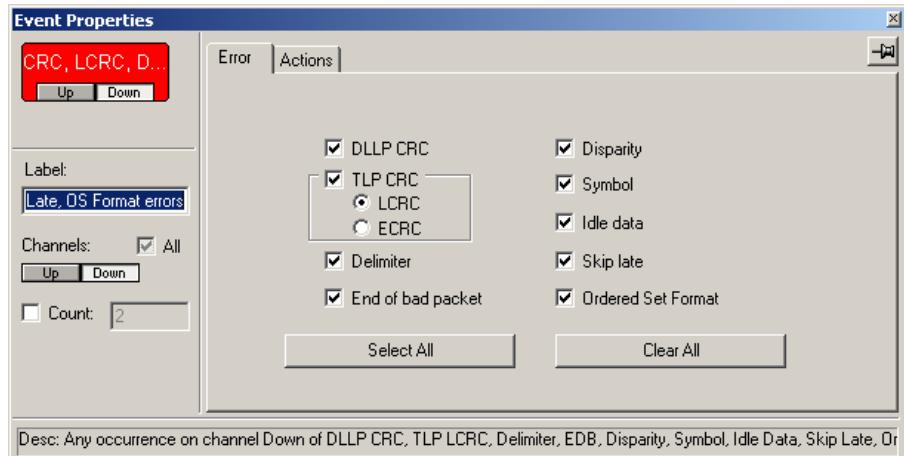
Reason: Filter Anything has the highest priority and overwrites filter-in rule.

8.8 Properties Dialog Boxes

Properties dialog boxes provide additional settings for Events, States, Actions, and other objects in the Recording Rules page. You can access a Properties dialog by double-clicking an **Event**, **State**, **Action** or other object.

8.9 Event Properties Dialog

The Event Properties dialog presents options for refining triggers and filters. For example, to set a trigger on a specific type of error, you open the Properties dialog



Accessing the Properties Dialog

To see the Properties dialog, first create an event button by clicking the **New Events** button and choosing an event from the menu. Afterwards, open the Event Properties dialog by doing one of the following:

- Double-click an event.
- Right-click an event and select **Properties** from the pop-up menu.
- Click the **Properties** button on the toolbar.

Dialog Settings and Features

Event Icon Preview: This icon shows you which event properties you are editing. The Icon Preview looks exactly like the icon in the Main Display area.

Icon Label: A text box for labeling the button. Whatever you type here appears on the button.

Channels: These controls allow you to select the channel(s) that the Analyzer should search when it is looking for the event.

Count: A counter tells the Analyzer to search for x instances of the selected event. For example, if you enter **10**, the Analyzer counts 10 instances of the selected event before it performs whatever action you assign. There are only two counts available in the hardware so if you try to assign more than two, you get a warning. Counters cannot be applied to events with Filter Actions. The maximum counter value is 65,535.

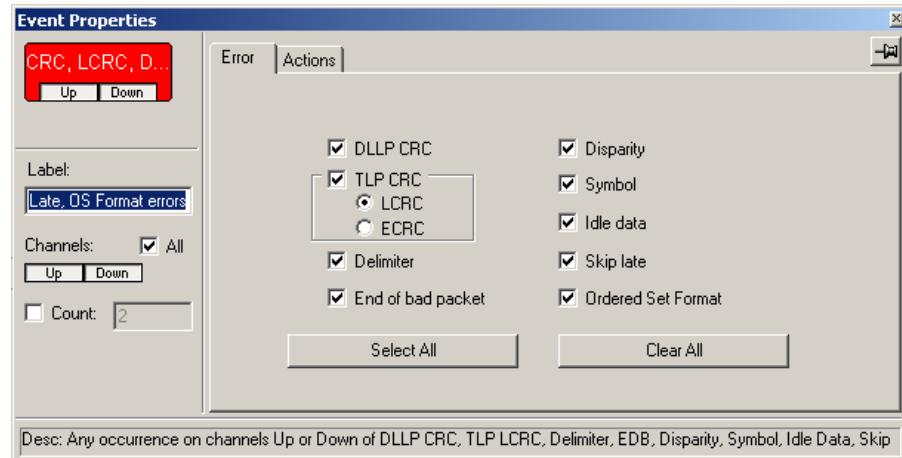
Pin Button: Allows you to **pin** the Properties dialog box to the application so that it does not go away when another object appears such as an event, state or action.

Description String: This area contains a textual description of the event.

Event-specific Settings: The largest part of the Event Properties dialog box. The settings in this area vary for different events. Some events do not have any additional settings (for example, Basic Link Services, Extended Link Services). The Events that do have settings are: Error Event, Data Frame Event, Primitive Event, Advanced Primitive Event, SCSI Command Event, Breakout Board Event, and Timer Event.

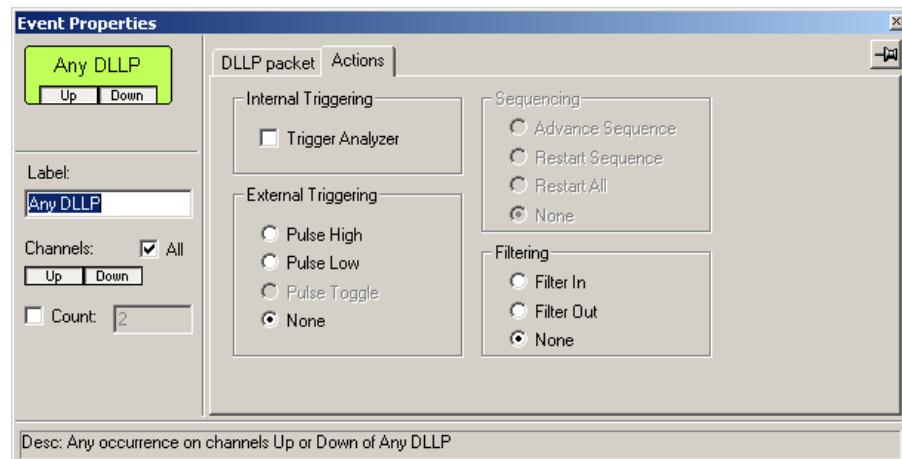
Error Properties Dialog

The Error Properties dialog box lets you select specific error types for performing an action. There are two sets of Error types: Packet Errors and Idle Errors.



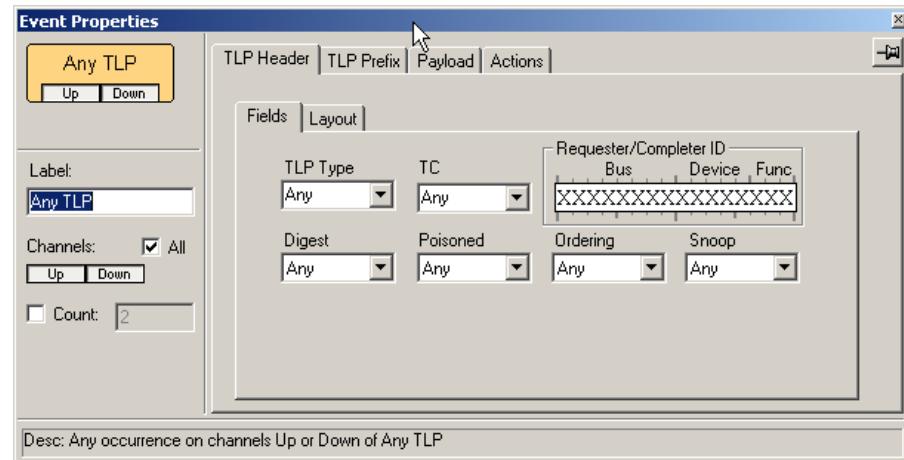
Actions Properties Dialog

The Actions Properties dialog box.



TLP Header Properties Dialog

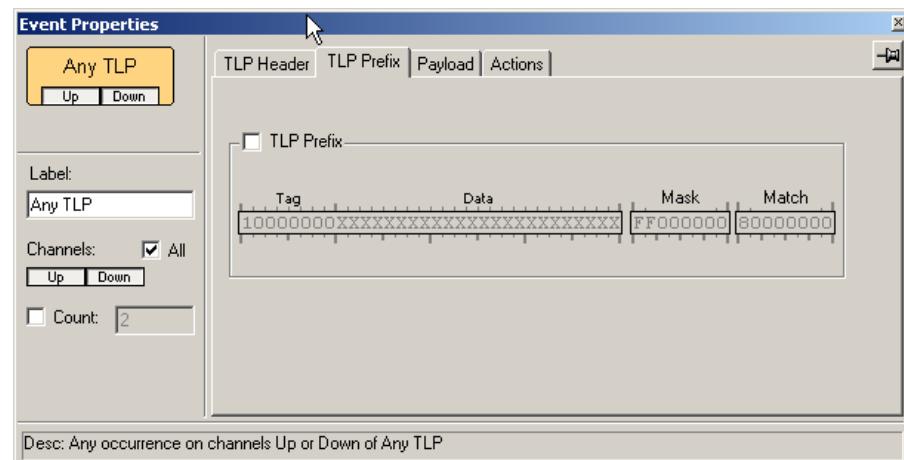
The TLP Header Properties dialog box.



Note: TLP Prefix is available only on Summit T2-16.

TLP Prefix Properties Dialog

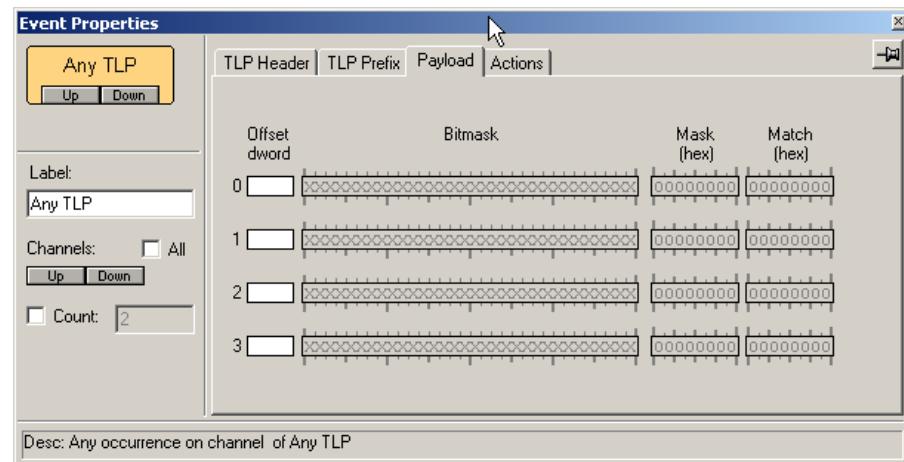
The TLP Prefix Properties dialog box.



Note: TLP Prefix is available only on Summit T2-16.

Payload Properties Dialog

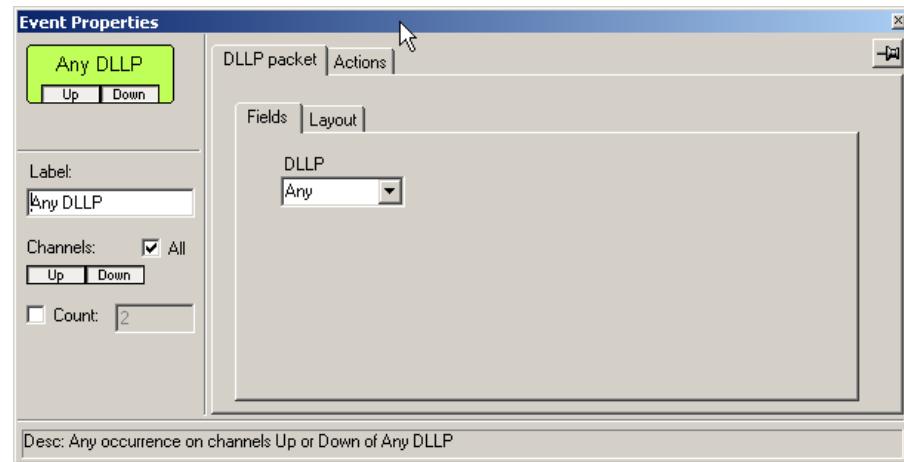
The Payload Properties dialog box.



Note: TLP Prefix is available only on Summit T2-16.

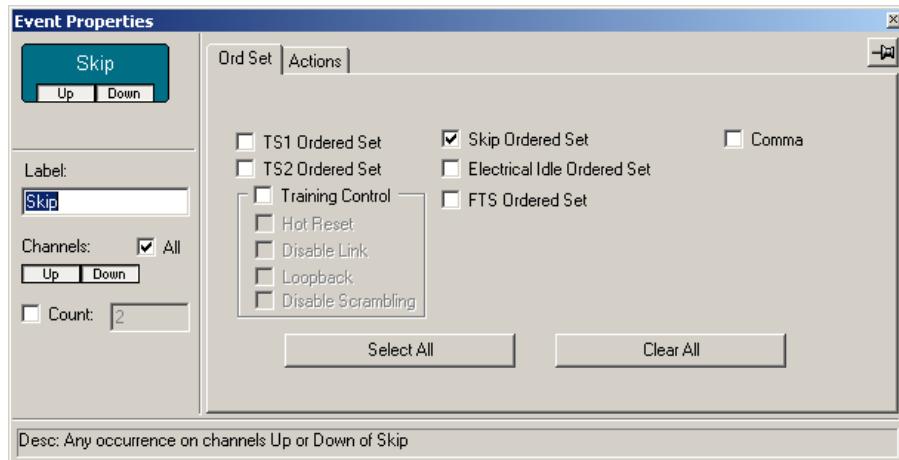
DLLP Packet Properties Dialog

The DLLP Packet Properties dialog box.



Ordered Set Properties Dialog

The Ordered Set Properties dialog box.

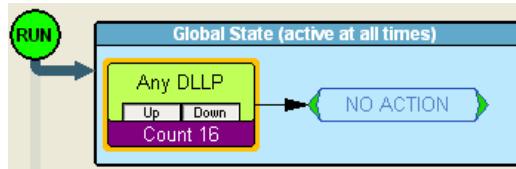


8.10 Counting Events

Triggers can be set on multiple instances of an event. For example, you can set a trigger to occur following five instances of any DLP. To configure the Analyzer to look for multiple events, you enable **Counters**. Counters tell the Analyzer how many occurrences of an event it should wait for before triggering.

For example, **Trigger following the 16th occurrence of an error**.

Counters enable triggers to be set that are based on a count of events. For example, you could use a counter to **Trigger following the 16th occurrence of a DLLP message**



To use a counter, follow these steps:

Step 1 Click an event. This causes an arrow to appear.

Step 2 Click one of the two counters (it does not matter which you use). This causes the counter to attach itself to the bottom of the event (shown above). An arrow automatically connects the counter to the Trigger button.

To change the counter value:

Step 1 Click the small blue dot in the upper-left corner of the counter button. A menu appears.

Step 2 Select **Change Counter Value**.

Step 3 Enter a new value in the pop-up dialog box. This causes the new value to appear in the counter button.

How to Set a Counter

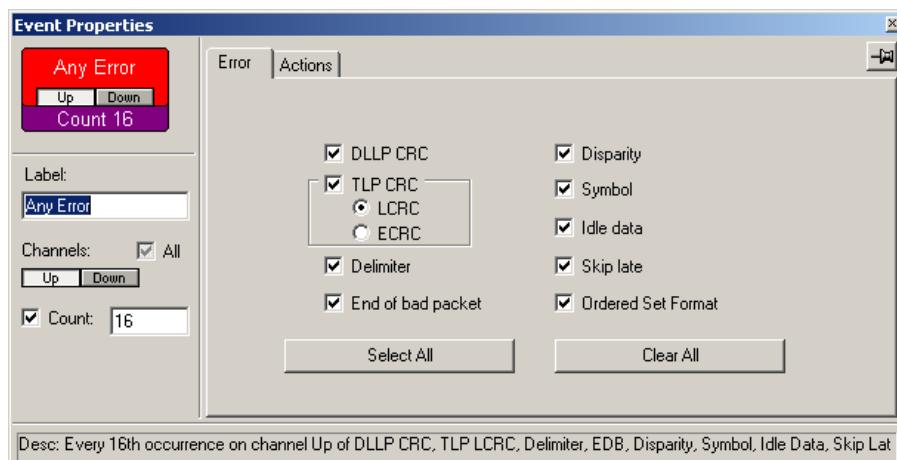
To set a counter:

Step 1 Open the Recording Rules page, select an event, and drag it to the **Global State** or **Sequence** cells. For details on these steps, see “Creating Recording Rules” on page 112.

Step 2 Counts can only be set on a per channel basis, so press the **Up** or **Down** channel buttons to select the channel on which the count is performed.

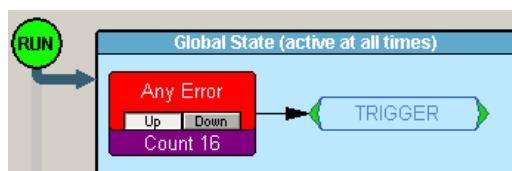


Step 3 Right-click the selected event and select **Add Counter** from the menu to open the Properties dialog.



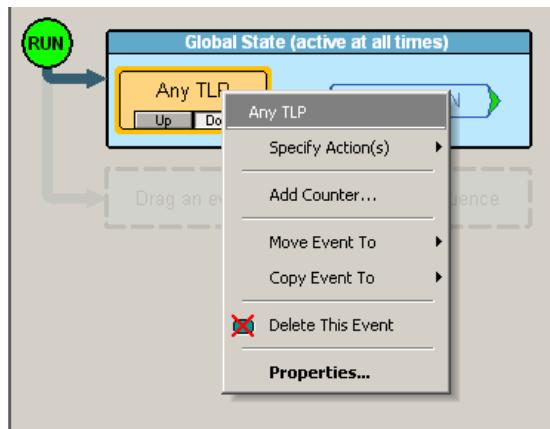
Step 4 In the text box to the right of the label Count enter a value. Make sure the checkbox to the left of the word Count is checked.

Step 5 Click the **X** in the top right corner of the dialog box to close the dialog. A counter button should appear just below your selected event.

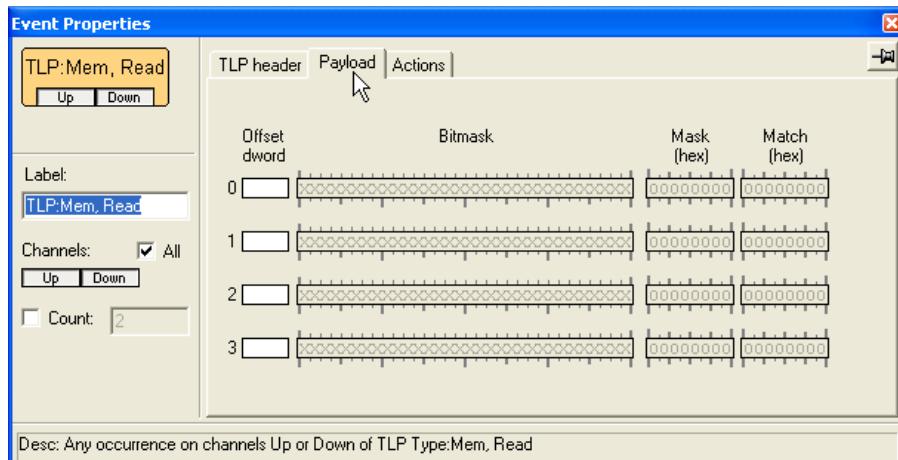


8.11 Creating a Payload Match

You can configure PETracer to trigger, count, and restart on a specific payload pattern within a Transaction Layer Packet (TLP). In Recording Rules, create a **New** event of the desired TLP type. An icon appears that represents that event type in the Available Events area. Right-click the icon and select **Properties** to bring up the Properties dialog box for the event.



Select the **Payload** tab to bring up the pane that lets you configure payload pattern. You can match up to four patterns, labeled 0 through 3.



For each pattern, you specify the following:

Offset dword: Indicates the DWORD you want to match within the payload (range is 0 through 1024). For example, if you want the Analyzer match a pattern in the first DWORD of the payload, enter 0. If you want the Analyzer to match a pattern in the thirty-fifth DWORD, enter 35.

Bitmask: Indicates which bits you want to match for the DWORD indicated. You can enter any of the following in the bitmask area:

- X (bit not relevant)
- 1 (present)
- 0 (bit not present)

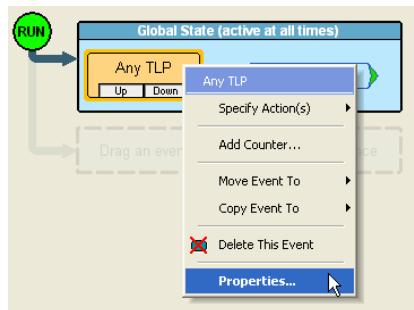
Note: The Mask (hex) and Match (hex) entries represent bitmask in hex format. As you type entries in the bitmask, corresponding values appear in fields in the hex Mask and Match. Alternately, you can type values in the hex Mask and Match, and corresponding values appear in the bitmask.

Example 1

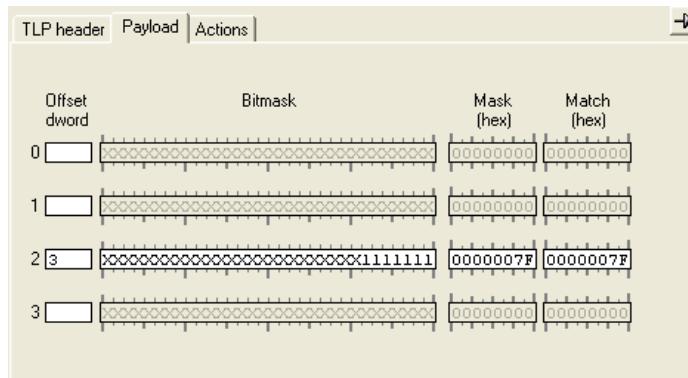
To tell the Analyzer to trigger on any payload with the binary pattern 1111111 in the third DWORD:

Step 1 Create an **Any TLP** event in the Available Events area of Recording Rules. Drag the event to the **Global State** cell.

Step 2 Open the **Properties** dialog box for the event and bring up the **Payload** pane.



Step 3 Enter 3 in the Offset dword area of any of the four patterns (0 to 3). For purposes of this example, we choose pattern 2.



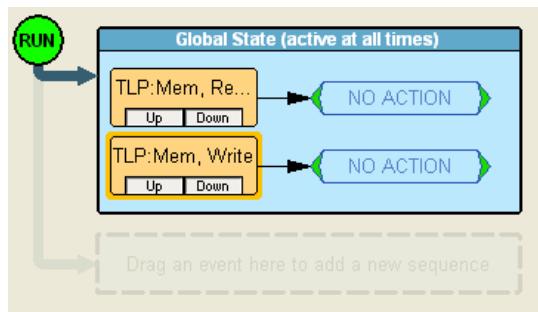
Step 4 Enter the following in pattern 2: 1111111.

Example 2

To tell the Analyzer to trigger on any payload with the binary pattern 1111111 in the third DWORD, OR to trigger on any occurrence of Memory Write:

Step 1 To set up the first condition, do steps 1 through 4 in Example 1.

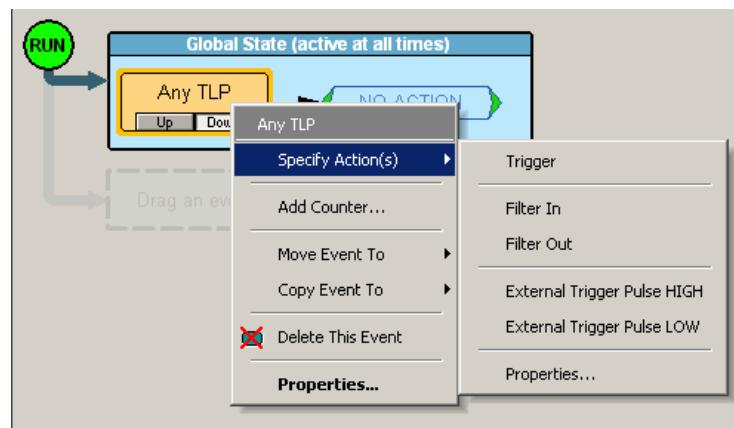
Step 2 Create a **Memory Write** event in the Available Events area of Recording Rules. Drag the **Memory Write** icon to the same cell as the **Any Event** icon from Example 1. The Analyzer now is set to trigger on either of the two conditions.



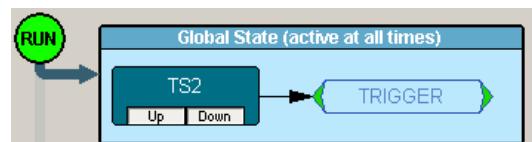
8.12 Trigger

A trigger is one of five actions that can be assigned to an event. (The other four actions are Filter In, Filter Out, Advance the Sequence, and Restart the Sequence.)

To enable a trigger, place an event button into either the **Global State** cell or the **Sequence** cell, then right-click the button and choose an **Action**.



From the sub-menu, select **Trigger**.



The exact end of the recording depends on how you have set the Trigger Position slider in the General page of the Recording Options dialog. This setting determines whether the recording terminates immediately following a trigger, or some time afterwards. See “General Tab” on page 100 for further explanation.

8.13 Filter In and Filter Out

A filter causes the Analyzer to filter in or out specified events from the recording. If events are filtered out of the recording, they are excluded from the Analyzer's buffer and not simply hidden from the CATC Trace. The purpose of filtering is to preserve recording memory so you conduct longer recording sessions and exclude events that do not interest you.

A filter causes the Analyzer to filter in or out specified events from the recording so you can preserve recording memory and thereby increase the duration of your recording. Filtering also lets you exclude unwanted data so your CATC Trace displays only the traffic that interests you.

To enable or disable filtering, place an event button into either the **Global State** cell or the **Sequence** cell, then right-click the button and choose an **Action** (see previous topic).

From the sub-menu, select **Filter In** or **Filter Out**.



Chapter 9: Reports and Tools

Reports assist you in analyzing traffic recorded by the Analyzer. The available reports are:

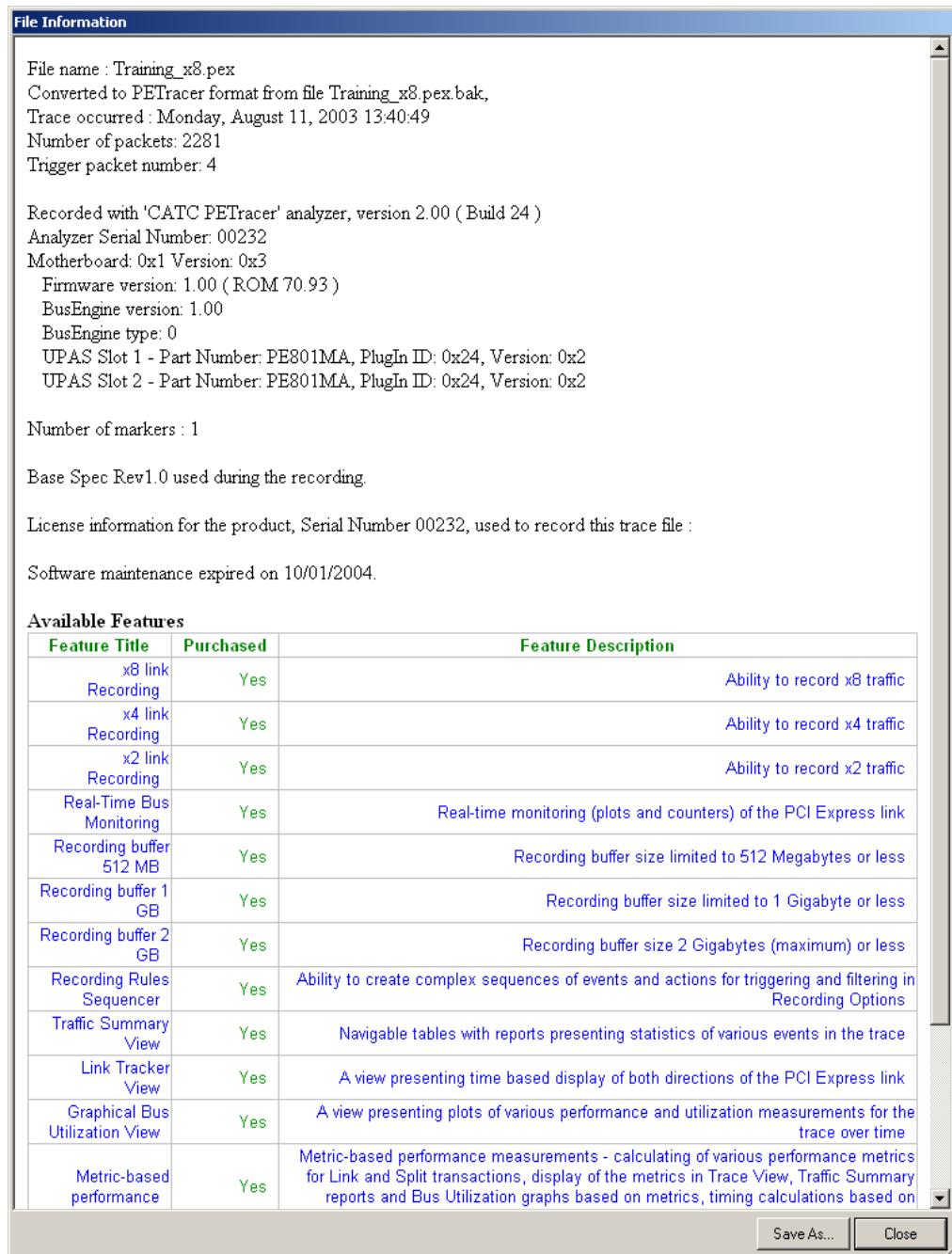
- **File Information:** To view general information about the CATC Trace file.
- **Error Summary:** To view a count of errors in a CATC Trace file.
- **Traffic Summary:** To view a summary of protocol-related information in the CATC Trace file summary information about a selected group of items in the CATC Trace file (such as a count of particular frame or packet types).
- **Bus Utilization:** To display information on bandwidth usage for the transmit and receive channels.
- **Link Tracker:** Displays a detailed chronological view of events.
- **Data Flow:** Shows marker, packet, direction, type, length, address, payload, hand-shake, and timestamp information.
- **Trace Navigator:** Navigates within the CATC Trace to view the location of errors and triggers, narrow the range of traffic on display, and jump to any point in the CATC Trace.
- **LTSSM Flow Graph:** Shows a state diagram of bus activity.
- **Packet Header:** Shows packet header information
- **Packet Data:** Shows packet information.
- **Configuration Space:** To display a Configuration Space (see “Configuration Space” on page 225).
- **Metrics:** Measures key operating parameters.
- **Real Time Statistics:** To display statistical information for the channels.
- **TC to VC Mapping:** To display how Traffic Classes are mapped to Virtual Channels (to simplify navigation) and how the CATC Trace display was changed (for example, in Split Transactions).
- **Timing Calculations:** To view timing measured between two events set within the CATC Trace file.
- **Run Verification Scripts:** Allows you to check errors, link transactions, split transactions, metrics, ordered sets, replays, DLLPs, and TLPs.

Reports are available from the Report menu and buttons on the Tool bar. Tools are available from the Tools menu.

9.1 File Information

The File Information window provides a summary on the currently displayed file.

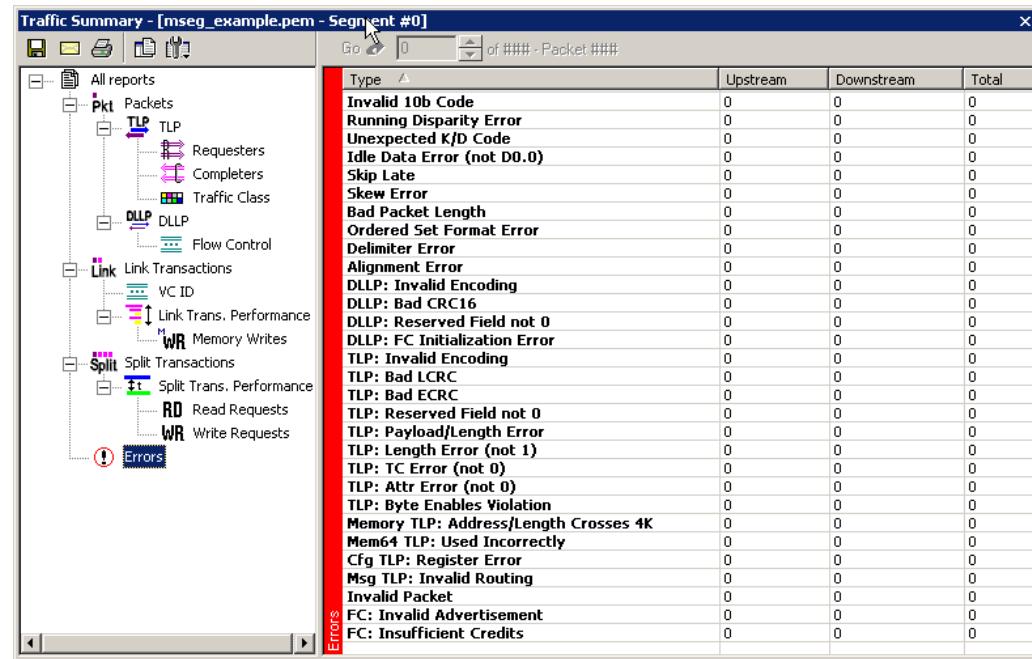
Select **Reports > File Information**  to obtain the File Information window.



9.2 Error Summary

The Error Summary dialog box displays the number of errors for each event and the packet containing the errors.

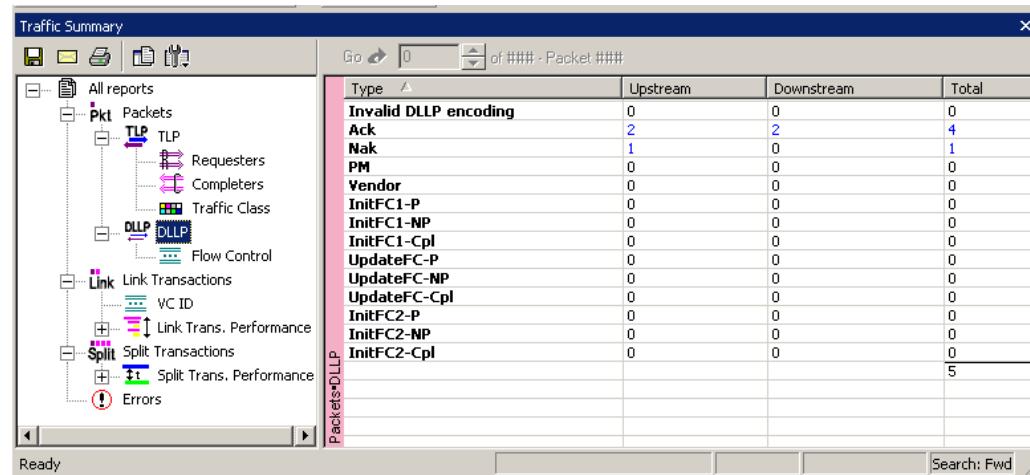
Select **Reports > Error Summary** to obtain the Error Summary dialog box.



9.3 Traffic Summary

The Traffic Summary window summarizes the traffic in the current CATC Trace. The left side of the window displays a tree of protocol levels. The right side displays a summary of traffic for the displayed levels.

Select **Reports > Traffic Summary** or click  to display the Traffic Summary window.



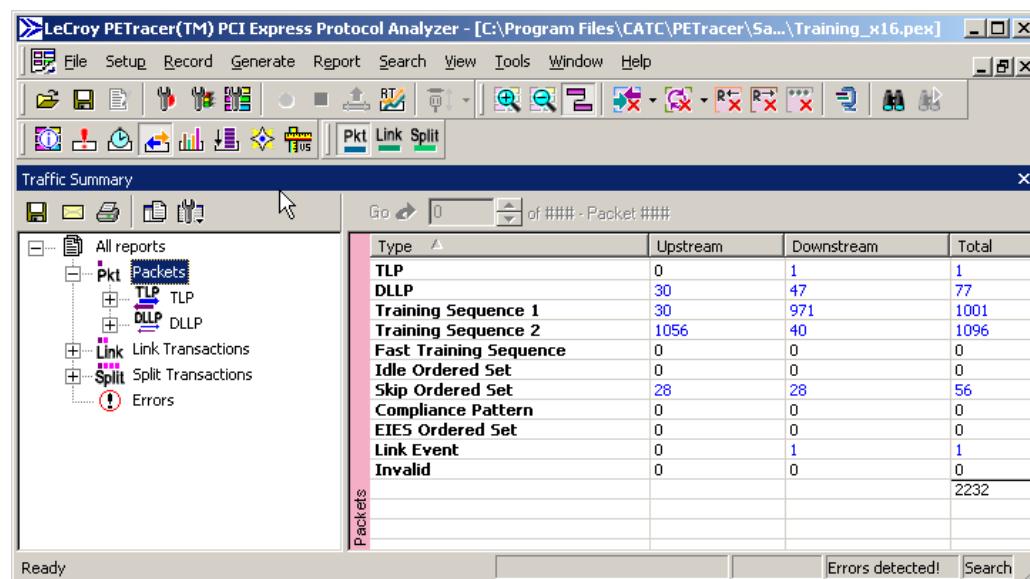
Buttons at the top of the Traffic Summary window change the display format and enable data to be exported to email, file, or the printer.

Using the Traffic Summary Window to Search the CATC Trace

You can use the Traffic Summary window to move the CATC Trace to packets of interest:

Step 1 Click one of the numbers in the right side of the Traffic Summary window.

The CATC Trace jumps to the first instance of the selected protocol.



Step 2 Click the **up** or **down** arrows  of . The CATC Trace jumps forward or backward through the display to the next instance of selected protocol level.

Traffic Summary Buttons

Buttons at the top of the Traffic Summary dialog box provide options for exporting the data or formatting its appearance:



Save. Saves Traffic Summary results into an HTML format.



Email. Attaches an HTML file of the results to a new email.



Print. Prints results.



Text. Displays results in HTML format.

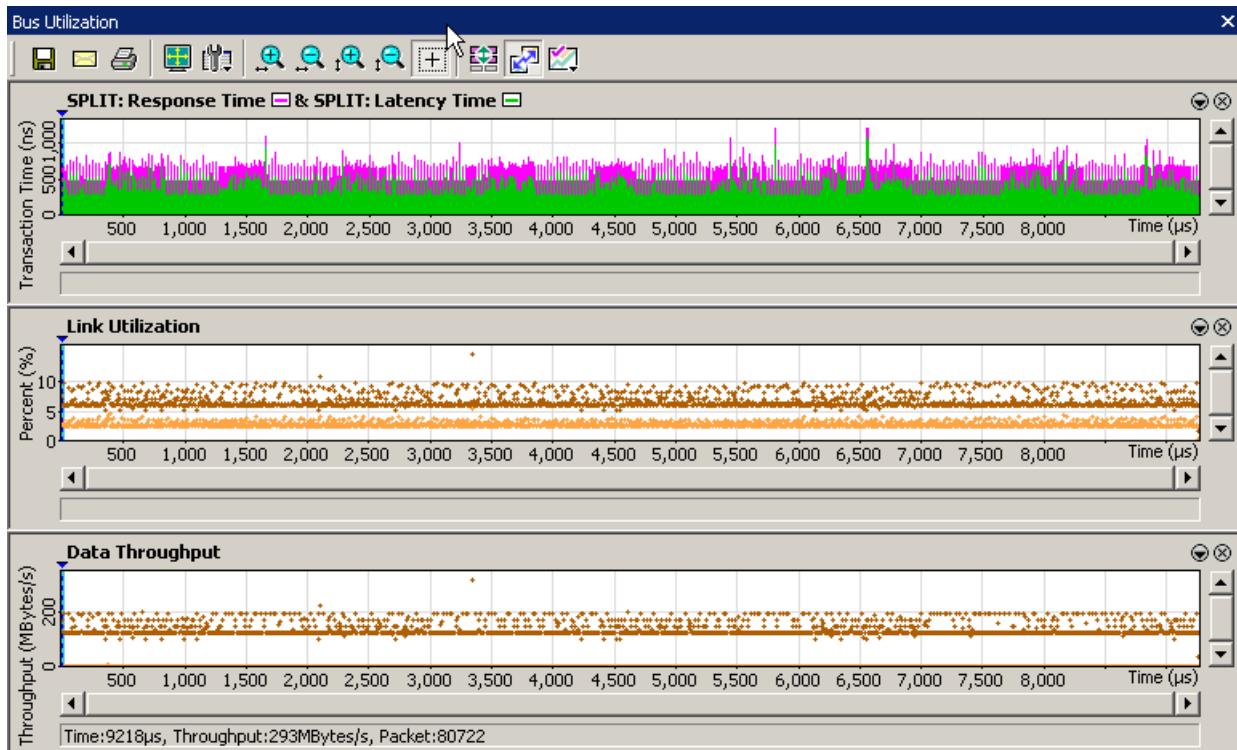


Options. Opens a drop-down menu with the following options:

- **Grid Lines:** Displays/Hides grid lines
- **Row Selection:** Allows entire rows to be selected
- **Tight Columns:** Reformats column widths to match data
- **Event Navigation:**
 - Skip Hidden Items
 - Show Hidden Items
 - Prompt each time

9.4 Bus Utilization

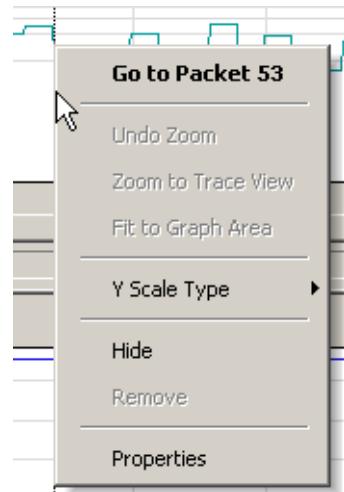
Select **Report > Bus Utilization** from the menu or press  to open the Bus Utilization window.



The Bus Utilization window displays information on bandwidth use for the transmit and receive channels.

Bus Utilization Pop-up Menu

You can reformat the display by right-clicking a graph and making a selection from the Bus Utilization pop-up menu.



Go to Packet #: Relocates the CATC Trace to the selected packet number.

Undo Zoom: If you have zoomed in, this command undoes the zoom.

Zoom to Trace View: Zooms in on graph to show traffic currently displayed in the CATC Trace screen.

Fit to Graph Area: Redisplays graph so that the entire CATC Trace fits inside graph area.

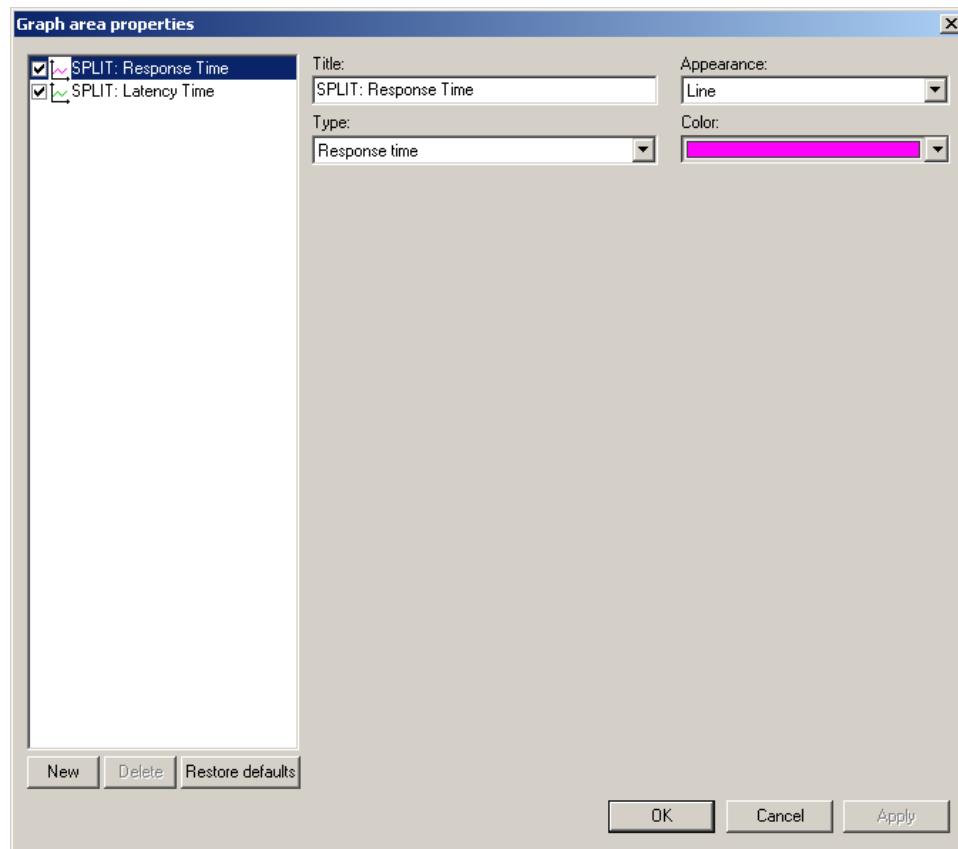
Y Scale Type:

- **Linear:** Converts display to linear format
- **Logarithmic:** Converts display to logarithmic format

Hide: Hides the selected graph

Remove: Allows you to remove any graph that you created via the **New**  command

Properties: Opens a dialog box with options for changing the Title, Type, Appearance, and Color of the graphs.

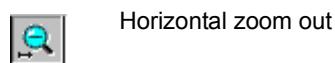
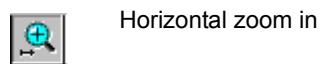
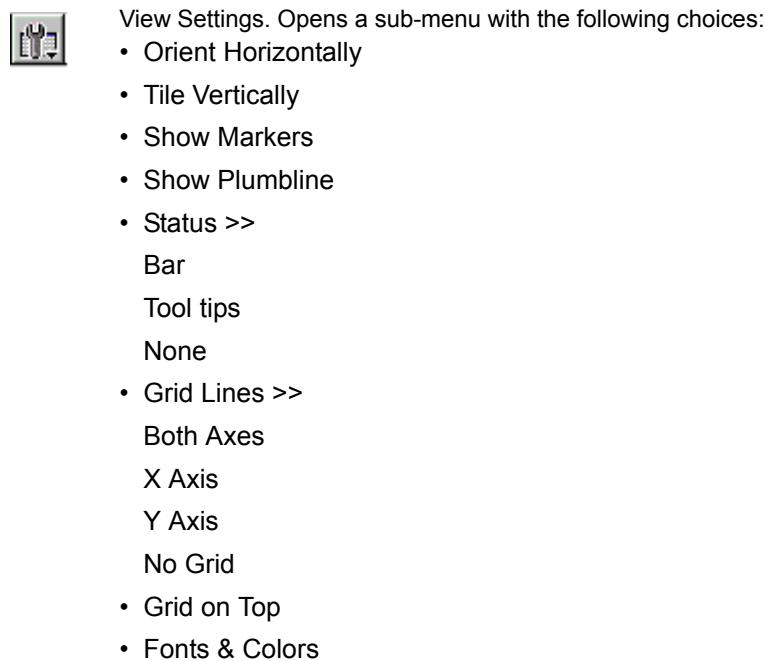
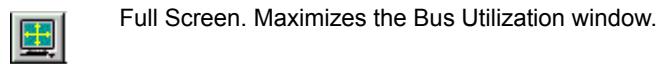
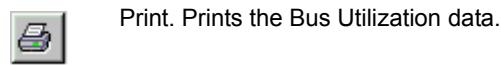
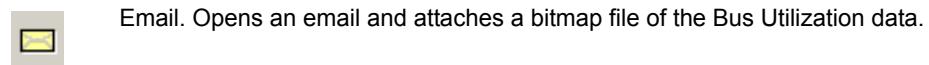
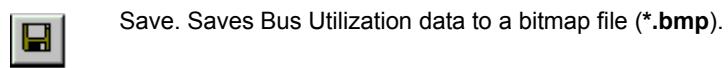


Bus Utilization Buttons

The Bus Utilization window buttons allow you to reformat the display and export data.



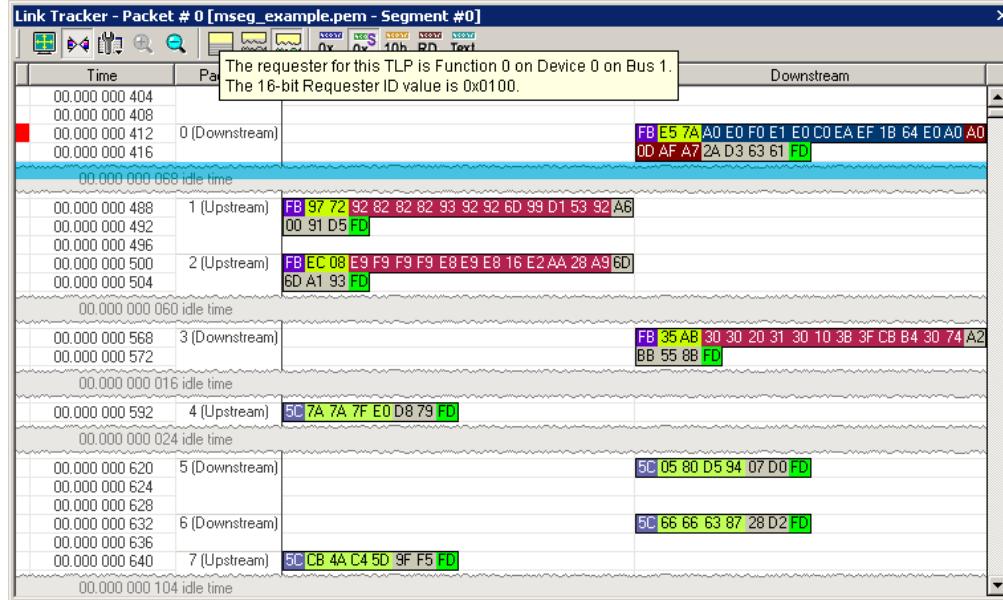
Button Function



-  Vertical zoom in
-  Vertical zoom out
-  Click and Drag zoom. Click and drag to zoom in on a part of the graph.
-  Select Range. Displays a dialog box for selecting a packet range.
-  Synchronize Graph Areas. If two or more graphs are displayed, this button synchronizes the graphs to one another. Once synchronized, the positioning slider of one graph moves the other graphs.
-  Graph Areas. Provides options for creating and displaying additional graphs of data lengths, packet lengths, and percentage of bus used.

9.5 Link Tracker

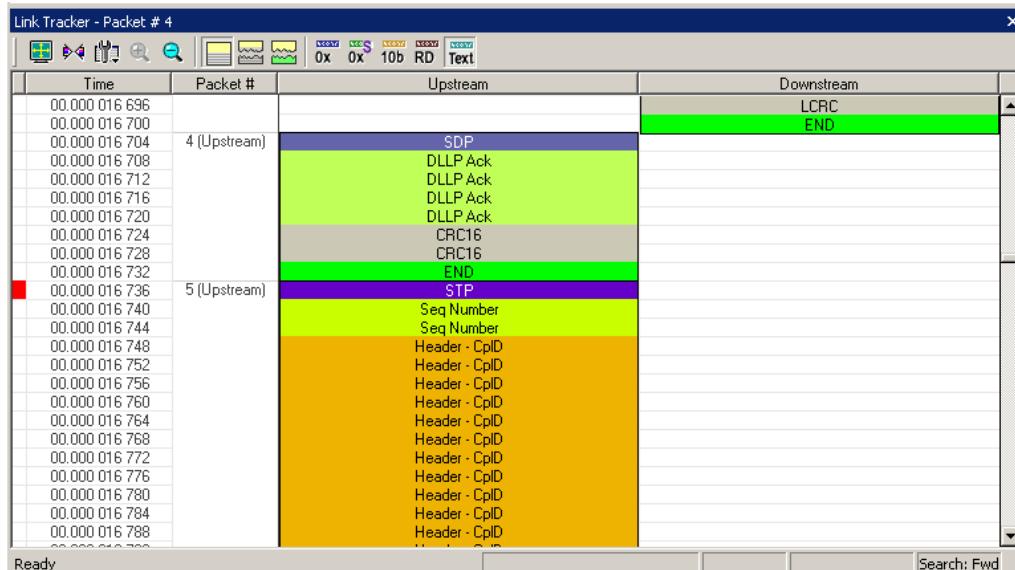
The Link Tracker window displays a detailed chronological view of events. Events are shown on a channel-by-channel basis in columns within the window.



Each time slot in the vertical axis represents the minimum time that a DWORD requires to traverse the bus.

Toolbar: Presents buttons for changing the format of the Link Tracker window.

Main Display Area: Displays traffic chronologically as it occurred in the recording. The window divides into columns: the first column shows time and traffic is shown on a channel-by-channel basis in the columns on the right.



Using the Link Tracker Window

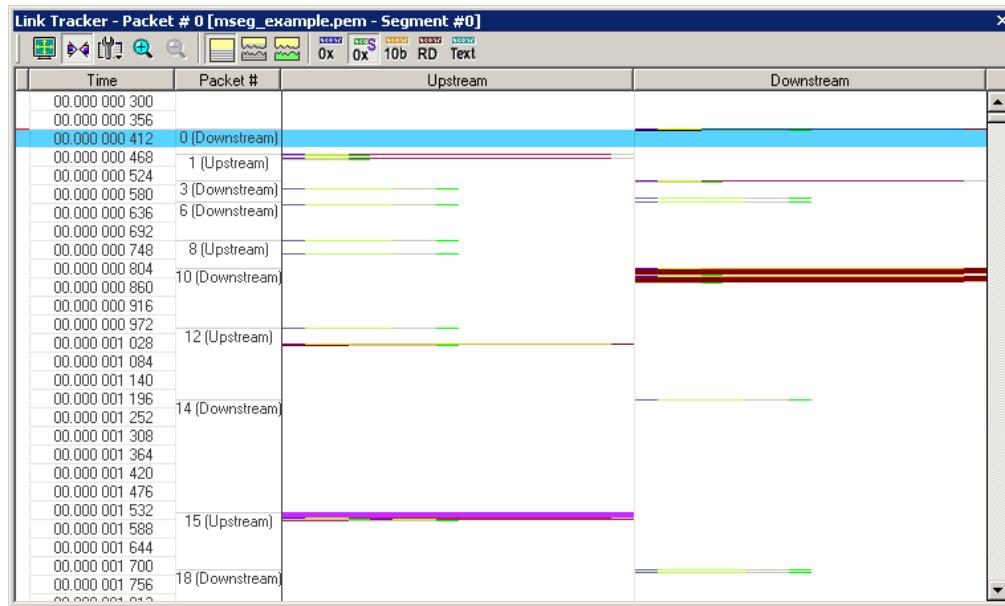
The Link Tracker window can be reformatted in several ways.

Zooming In and Out

Zooming out can give you a quick, high-level view of a CATC Trace. A fully zoomed out CATC Trace only shows columns and colored lines. Using the colors, you can see what types of traffic run through the CATC Trace.

Further information can be obtained on any point of interest in the CATC Trace by positioning your mouse pointer over it. Tool tips provide detailed description of events.

Note: When fully zoomed out, the smallest graphical unit is the DWORD, represented by a single line. Zooming out makes the CATC Trace appear smaller and increases the time scale in the first column.



Collapsing Idle Time, Enabling Tool tips, and Resetting Column Widths

Click the **View Options** button  to open a menu with options for formatting the display. Three options are presented:

Collapsible Idle Time: Opens a dialog box for setting the Idle time value. Setting a value tells the Analyzer when to collapse Idle times and display them as grayed out strips within the Bus View window.

Tooltip Display: Opens a menu with options for adding content to Tooltips. Tooltips display when you position the mouse pointer over an item in the Bus View window. The options are:

- Tooltips Display Values
- Tooltips Display Scrambled Values
- Tooltips Display 10-bit Codes
- Tooltips Display Symbols

Time Format: Seconds or Clock

Reset Column Widths: This option resets column widths to their defaults and enables columns to resize themselves automatically any time the application window is resized. Normally, columns automatically resize themselves if the application window is made larger or smaller. However, if you manually resize any columns in the Bus View window, column widths become static. Thereafter, if you resize the application window, the Bus View columns do not adjust automatically. Reset Column Widths re-enables the automatic resizing capability.

Reset Columns Order: Return to default column sequence.

Docking and Undocking the Window

You can undock the Link Tracker window by double-clicking the blue title bar along the left side of the window. Once undocked, the window can be dragged anywhere in the application. To redock, double-click again on the title bar.

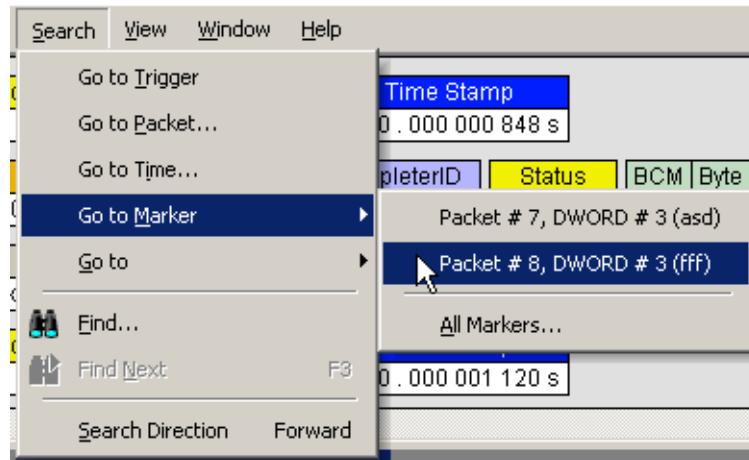
Setting Markers

Markers can be set on any event within the Link Tracker window.

To set a marker, right-click an event, then select **Set Marker** from the pop-up menu.

Once marked, you can navigate to events with the **Go to Marker** command in the Search menu.

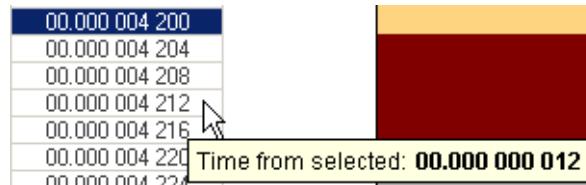
Markers set in the Link Tracker window display the packet number and DWORD number. In contrast, markers set in the CATC Trace window just show the packet number.



Calculating Time between DWORDs

You can calculate time between DWORDs by clicking an event and then positioning your mouse pointer over a second event and reading the ensuing Tool tip.

Click the **time value** for the first event. Scroll down through the CATC Trace to the second event and position the mouse pointer above its time value. A Tool tip appears showing the time interval between the first and second events.



Hiding Traffic

You can hide Idles and other data from the Link Tracker window by clicking the **Hide** buttons on the toolbar.

Link Tracker Buttons

The Link Tracker window has a row of buttons for changing the format of the displayed data and for exporting data: The buttons have the following functions:



Full Screen. Expands the Link Tracker window to fill the entire screen.



View Options. Opens a menu with three options:

- **Collapsible Idle Time** (Collapse Idle Bigger Than **n** nanoseconds.
Note: Does not affect Collapse Idle Plus.)
- **Tooltip Display** (Values, Scrambled Values, 10-bit Codes, Symbols)
- **Time Format** (Seconds, Clock)
- **Reset Columns Widths** (return to default widths)
- **Reset Columns Order** (return to default column sequence)

See “Using the Link Tracker Window” on page 146 for further details.



Synchronize Trace View. Synchronizes the Trace View and Link Tracker windows so that a move in one window repositions the other.

Because of the differences in scale and logic between the Link Tracker and Trace view window, scrolling produces different effects depending on which window is being scrolled.

Scrolling in the CATC Trace window causes the Link Tracker window to rapidly jump from event to event. Long periods of idle time are thus skipped.

Scrolling in the Link Tracker window, in contrast, produces modest movements within the CATC Trace window.

Scrolling in the Link Tracker window causes the CATC Trace window to pause until the beginning of a packet is displayed. At that point, the CATC Trace window repositions itself. While scrolling long Idle periods or through the contents of a packet, the CATC Trace window does not move.



Zoom In



Zoom Out



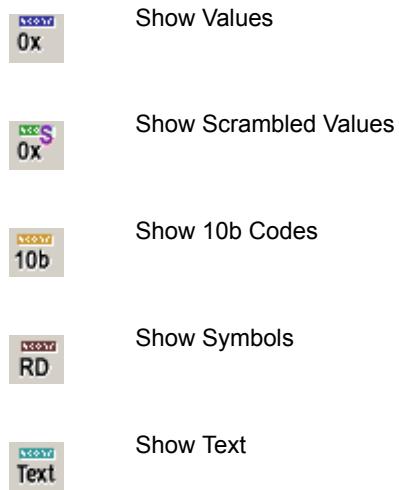
Continuous Time Scale. No collapsing.



Collapse Idle. Do not show some periods of Link being idle.



Collapse Idle Plus. Do not show periods of Link being idle.

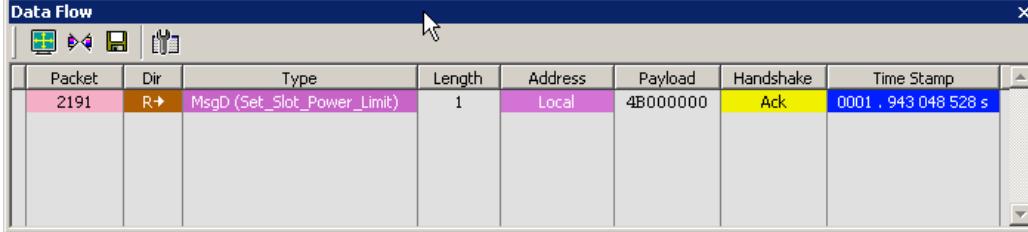


9.6 Data Flow Window

The Data Flow window shows marker, packet, direction, type, length, address, payload, handshake, and timestamp information.

To obtain the Data Flow window, select **Report > Data Flow**

or click the  Data Flow toolbar icon.

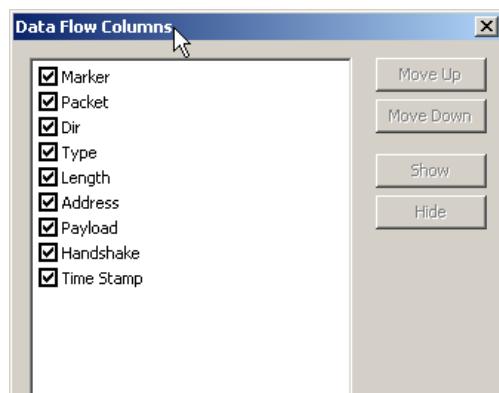


Packet	Dir	Type	Length	Address	Payload	Handshake	Time Stamp
2191	R→	MsgD (Set_Slot_Power_Limit)	1	Local	4B000000	Ack	0001 , 943 048 528 s



The toolbar allows you to:

- Expand the window to full screen or Collapse to a smaller window.
- Synchronize.
- Save.
- Select Data Flow columns to display and their widths:
 - Marker
 - Packet
 - Direction
 - Type
 - Length
 - Address
 - Payload
 - Handshake
 - Time Stamp

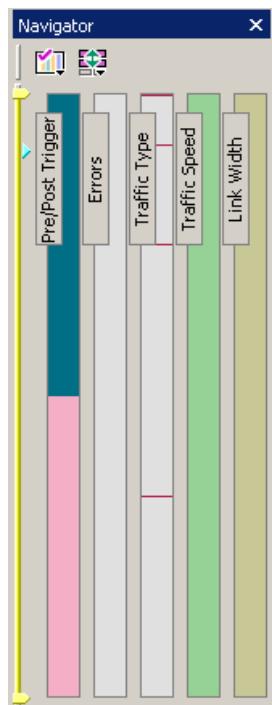


9.7 Using the Trace Navigator

The trace Navigator is a tool for navigating within the CATC Trace. It allows you to view the location of errors and triggers in a CATC Trace and to narrow the range of traffic on display. It also allows you to quickly jump to any point in the CATC Trace.

Displaying the Navigator

Click  in the toolbar to display the Navigator. The Navigator appears on the right side of the Main window. It has a two-button toolbar and a vertical slider bar. It also has colored panes for navigating the CATC Trace in different ways. You set which panes are displayed through Navigator pop-up menus.



Navigator Toolbar

The Navigator toolbar lets you quickly set Navigator features. The toolbar has two buttons.



Navigator Ranges: This button brings up a pop-up menu that lets you reset the Navigator range. The range determines what packets are viewable in the CATC Trace display.



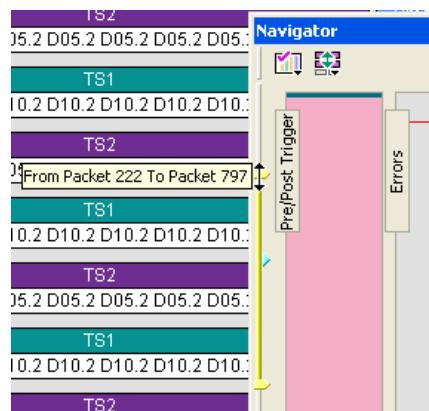
Navigator Panes: This button has two purposes: To select which Navigator panes appear and to bring up the Navigator legend. The legend determines how information is shown in the panes.

Navigator Ranges

You set the viewing range by dragging the **yellow range delimiters** along the slider.

To set the lowest packet viewable, drag the **top delimiter up**. As you do so, a tool tip appears to indicate the current range. Stop dragging when you reach the desired lowest packet.

To set the highest packet viewable, drag the **bottom delimiter down**. Stop when the tool tip indicates you are at the desired highest packet.



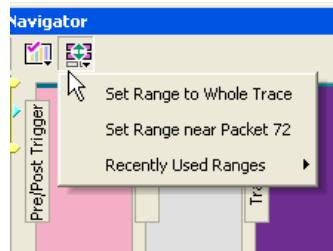
To Determine Current Position

In addition to the two range delimiters, the slider has a **blue current-position** indicator (see above). The current-position indicator shows where you are in the CATC Trace display with respect to the possible viewing range.

For example, suppose you set viewing range to packet 0 through packet 500 (the top range delimiter is at packet 0, and the bottom range delimiter is at packet 500). If you then move the current-position indicator on the slider to midway between the top and bottom delimiters, then packet 250 appears in the middle of the CATC Trace display.

To Reset Navigator Range

You can reset the Navigator range using the toolbar **Navigator Range** button. Press the button to bring up the Navigator Range drop-down menu.

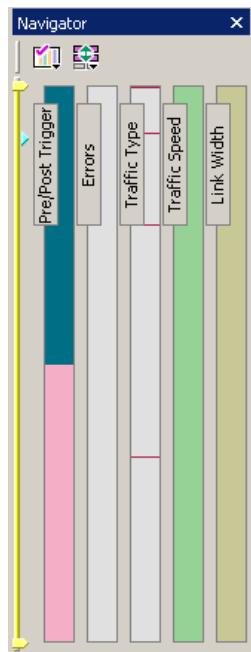


The menu has the following options:

- **Set Range to Whole Trace:** Allows you to reset the range to include the entire CATC Trace file contents. The top range delimiter is placed at the lowest packet number in the CATC Trace. The bottom range delimiter is placed at the highest packet number in the CATC Trace.
- **Set Range Near Packet xxx:** Allows you to collapse the range so that only the packets immediately above and below the xxx packet are displayed. The xxx packet is whatever packet is currently at the top in the CATC Trace display.
- **Recently Used Ranges:** Allows you to reset the range to any of a number of recently used (previously set) ranges.

Navigator Panes

You can display any combination of CATC Trace Navigator panes.



From left to right, the panes are: Pre/Post Trigger, Errors, Traffic Type, Traffic Speed, and Link Width. Each pane represents the entire CATC Trace with respect to different types of information. The top of each pane represents the start of the CATC Trace file, and the bottom represents the end of the CATC Trace file.

- **Pre/Post Trigger:** To view the trigger event in the CATC Trace and the relative size of pre-trigger and post-trigger portions of the CATC Trace. The two portions are set apart as different colors. The trigger event occurs at the point the two colors meet.
- **Errors:** To view any errors in the CATC Trace. A thin red line represents each error in the pane.
- **Traffic Type:** To view the types of packets that occur in the CATC Trace. A different color represents each packet type in the pane. The relative size of colored portions in the pane corresponds to the amounts of the various packet types in the CATC Trace. As described below, you can use the Navigator legend to change the types of packets that take precedence in the display.
- **Traffic Speed:** To view the speed that occurs in the CATC Trace.
- **Link Width:** To view the link width that occurs in the CATC Trace.

To Show/Hide Navigator Panes

You can show/hide any of the panes using pop-up menus accessible through left-click the **Navigator Panes** button or by right-click anywhere in any CATC Trace Navigator pane.

Navigator Slider

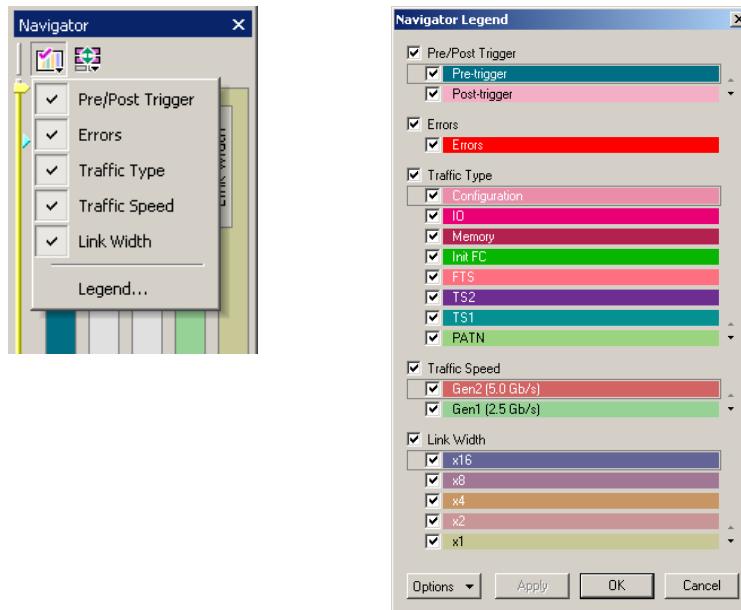
The Navigator slider appears at the left of Navigator panes. The slider has **yellow upper and lower range delimiters** and a **blue current-position** indicator.

The Navigator slider lets you to set the range of packets viewable in the CATC Trace display. In other words, it sets scrolling range of the display. You can scroll the display up to the lowest packet number in the viewing range. You can scroll the display down to the highest packet number in the viewing range.

Trace Navigator Legend

The Navigator legend lets you control the display of content in Navigator panes.

You bring up the legend through the Navigator Panes drop-down menu. Press the toolbar **Navigator Panes** button to access the menu. Select the **Legend** option to bring up the Navigator Legend dialog box.



The Navigator Legend dialog box has areas corresponding to each of the panes. Each area has check boxes that allow you to hide/display information in the pane. You can set the priority of information displayed in the panes using the up and down triangles on the right.

Using the Legend to Show/Hide Navigator Panes

To use the legend to show/hide an entire pane, use the **checkbox** next to the name of each pane in the legend.

In the case of the Pre/Post Trigger and Errors areas, the action of show/hide in the legend is identical to that provided by Trace Navigator pop-up menus.

In the case of the Traffic Types pane, there is no equivalent show/hide available through the pop-up menus.

Using the Legend to Set the Priority of Information Display

You can use the legend to set the priority of information displayed in the Pre/Post Trigger Traffic Type panes. This is a two-step process.

Step 1 For a particular item in a pane, click the **column next to the checkbox** for the item. That labels the item as currently active.

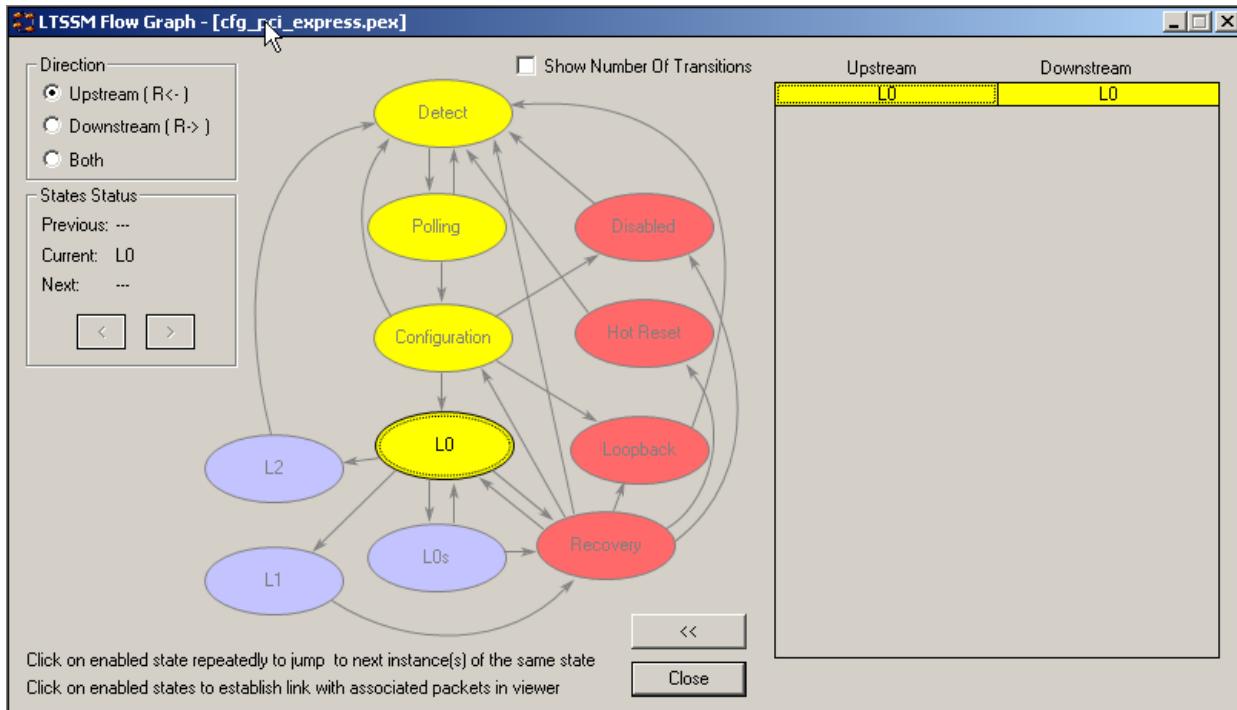
Step 2 Next, use the **up-down** at the lower-right of the area to move the item higher or lower in priority.

In the case of the Traffic Type pane, priority determines display priority of each packet type. For portions of the CATC Trace that are dominated by a particular packet type, this setting no effect: only the color corresponding to that packet type is displayed in that portion of the pane. Suppose, however, that part of the CATC Trace includes equal or near equal numbers of several types of packets. In that case, you can use the legend to select which among those types is represented in that portion of the Traffic Types pane. This allows you to view only packets of interest in crowded portions of the CATC Trace display.

9.8 LTSSM Flow Graph

The LTSSM Flow Graph shows link state transitions that the link goes through, as recorded in the CATC Trace file.

To obtain the LTSSM Flow Graph, select **View > LTSSM Flow Graph**.



You can display the following directions:

- **Upstream**
- **Downstream**
- **Both**

You can **Show Number of Transitions**.

9.9 Packet Header Bar

The Packet Header bar shows packet header information.

To obtain the Packet Header bar, select **Report > Packet Header**

or click the  Packet Header toolbar icon.



The toolbar allows you to Save, go to Previous or Next, display Hexadecimal or Binary, and show the Packet Data window.

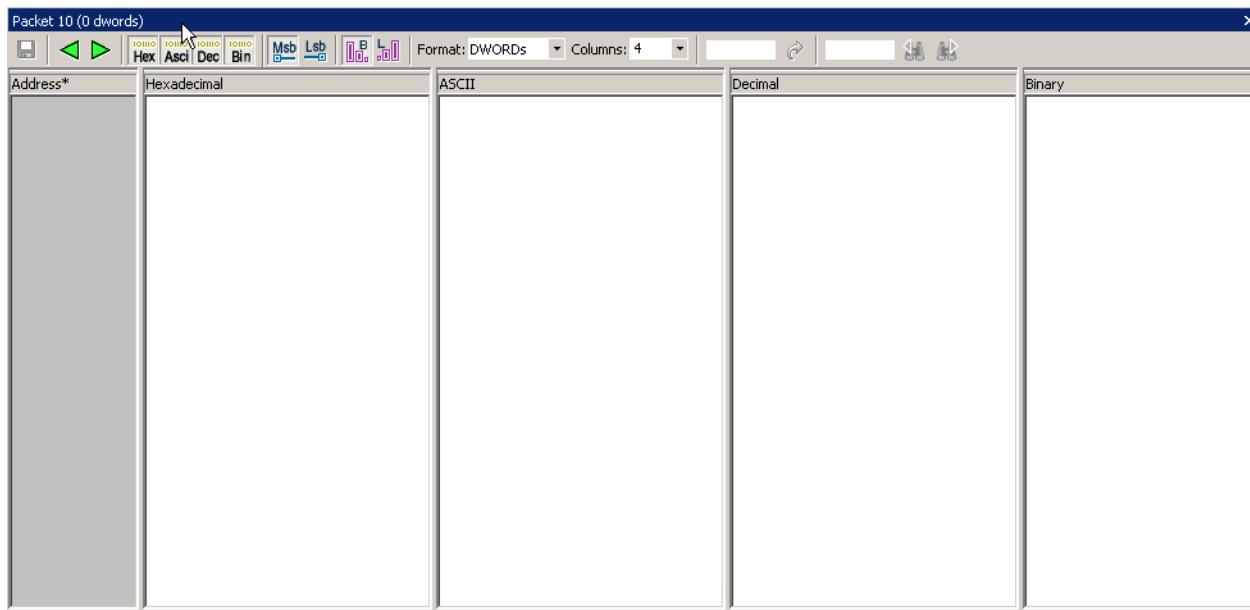


9.10 Packet Data Window

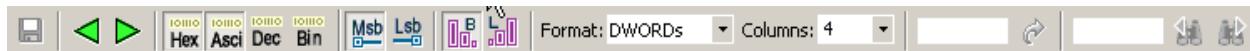
The Packet Data window shows packet information.

To obtain the Packet Data window, select **Report > Packet Data**

or click the  toolbar icon.



The toolbar allows you to Save; go to Previous or Next; display Hexadecimal, ASCII, Decimal, or Binary; use MSB Format or LSB Format; and use Big Endian or Little Endian.



Format and Columns allows you to enter the number of bytes, words, or dwords per line.

You can enter an Offset and scroll to it.

You can enter text and Search Previous or Search Next.

9.11 Configuration Space View

The Configuration Space View displays information about the Configuration Space state as of the current packet of the currently selected device. The view shows the Configuration Space Header and the PCI-compatible or PCI Express Capability Structures.

To display the Configuration Space View for a device at a packet:

Step 1 Open a CATC Trace, such as the sample file **cfg_pci_express.pex**.

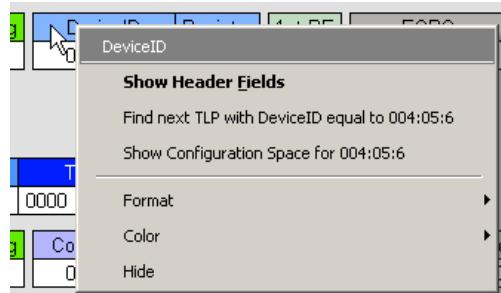
Step 2 Scroll to a packet with a Configuration header.

Packet	R→	2.5 x1	TLP	Cfg	CfgRd1	Length	RequesterID	Tag	DeviceID	Register
8					00:00101	1	001:02:3	29	004:05:6	0x044
Time Delta						Time Stamp				
96.000 ns						0000 . 000 000 544 s				
Packet	R-	2.5 x1	DLLP	ACK	AckNak_Seq_Num	CRC 16	Idle	Time Stamp		
9					27	0x5989	0.000 ns	0000 . 000 000 640 s		
Packet	R-	2.5 x1	TLP	Cpl	CplID	Length	RequesterID	Tag	CompleterID	Status
10					10:01010	1	001:02:3	29	004:05:6	SC

Step 3 Select **Report > Configuration Space > <device>** to display the Configuration Space View.

or

Click a **CompleterID** or **DeviceID** field. A pop-up menu opens.



Select **Show Configuration Space for xxxx** from the menu, where **xxxx** is the device number. The Configuration Space View opens.

On the left, the view displays the Configuration Space for the selected CompleterID or DeviceID at the current packet. You can select **Configuration Space Header** or a **Capability Structure**.

The right displays the decoded data of the selected Configuration Space Header or a Capability Structure, up to the current packet. (The decoding builds while navigating through the next packets.)

The Configuration Space View toolbar allows you to Save, go to First, go to Previous, go to Next, go to Last, go to Previous Access to Selected Configuration Space Register, go to Next Access to Selected Configuration Space Register, and display Hexadecimal or Binary.



Note: See Appendix A “Configuration Space Decoding” on page 233.

9.12 Using Unit Metrics

For every protocol unit at the Link or Split transaction level, PETracer™ calculates and displays a set of metrics. Metrics are measurements of key operating parameters. You can use metrics to evaluate performance of traffic in the CATC Trace stream.

You can view metrics information in the CATC Trace display, the Traffic Summary window, and the Bus Utilization window.

PETracer defines different metrics for Link and Split transactions.

Metrics Defined for Link Transactions

Number of Packets: The total number of packets that compose this Link transaction.

Payload: The number of data payload bytes this Link transaction transferred.

Response Time: The time it took to transmit this Link transaction on the PE link, from the beginning of the first packet in the transaction to the end of the last packet in the transaction.

Data Throughput: The payload divided by response time, expressed in megabytes per second.

Note: Usually, the Number of Packets metric for a link transaction is two (in case of explicit acknowledge) or one (in case of implicit acknowledge). However if Naks/link level retries are involved, this metric might be higher. As a result, the Number of Packets metric is useful in highlighting unusual link transactions.

Metrics Defined for Split Transactions

The following types of metrics currently are defined for Split transactions:

Number of Link Transactions: The total number of Link transactions that compose this Split transaction.

Payload: The number of payload bytes this Split transaction transferred.

Response Time: The time it took to transmit this Split transaction on the PE link, from the beginning of the first packet in the Split transaction to the end of the last packet in the Split transaction;

Data Throughput: The transaction payload divided by response time, expressed in megabytes per second.

Latency Time: The time measured from the end of the request transaction to the first completion transmitted in response to the request within this Split transaction.

Note: The Number Of Link Transactions metric for a Split Transaction usually is two for a Configuration or IO request. It can be bigger than two for a Memory Read request.

Show Metrics in the CATC Trace Display

In the CATC Trace view display of Link Transaction or Split Transaction levels, all metrics information applicable to a specific protocol unit is displayed in a Metrics header. The header is located close to the end of the unit, in front of the Time cell. You can expand and collapse the header to show or hide the metrics information.

Collapsed Metrics Header Display

Following is a collapsed metrics display for a unit of Link Transaction. The collapsed header display shows only the metrics cell representing the Number of Packets.

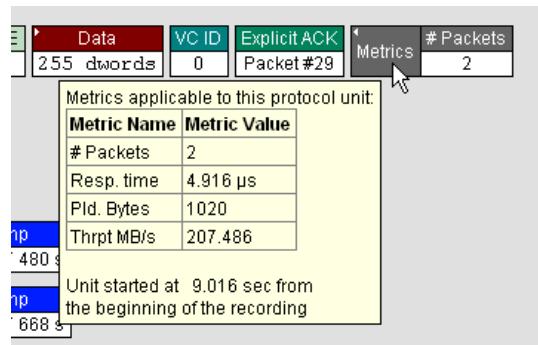
Link Tra	R→	TLP	Mem	MWr(32)	Data	Metrics	# Packets
31250		819		10:00000	2 dwords		2

Following is a collapsed metrics display for a unit of Split Transaction. The collapsed header display shows only the metrics cell representing Number of Link Transactions.

Split Tra	R←	Mem	MRd(32)	Status	Data	Metrics	# LinkTras
14342			00:00000	SC	4 dwords		2

Metrics Tool Tip Display

In both CATC Trace level views, you can view the summary of all the unit metrics in the Metrics header tool tip. To view the tool tip, simply place the mouse cursor over the Metrics header. Following is the tool tip for a unit in the Link Transaction view.



Note: The tool tip also presents information for time passed from the start of the recording till the beginning of this Link or Split Transaction.

Expanded Metrics Header Display

When you expand the Metrics header, the display creates a separate cell for each applicable metric:

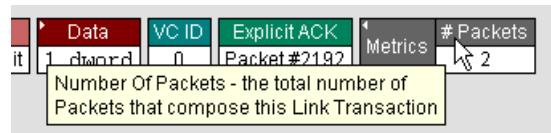
Following is the expanded Metric header for a unit in the Split Transaction view.

Metrics	# LinkTras	Resp. time	Latency	Thrpt MB/s	Pld. Bytes
	2	7.460 µs	6.736 µs	2.145	16

Following is the expanded Metric header for a unit in the Link Transaction view.

Metrics	# Packets	Resp. time	Pld. Bytes	Thrpt MB/s
	2	536.000 ns	64	119.403

Note: Each of the metric cells pops up a tool tip window with the explanation of what the metric means.

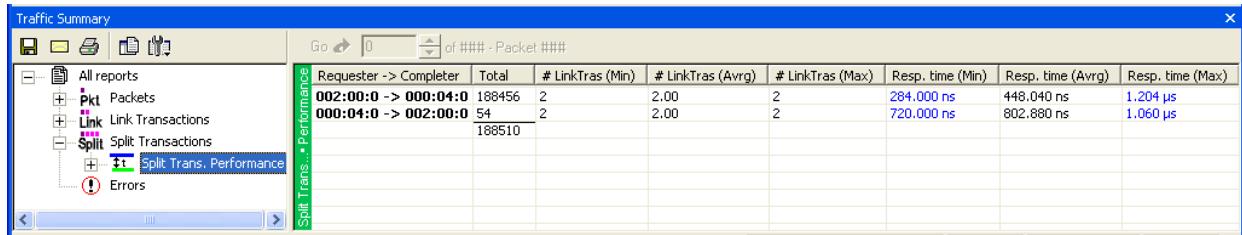


Show Metrics in the Traffic Summary Window

Some of the Traffic Summary reports at the Link and Split Transaction levels are based on metrics collected for the corresponding protocol units in the CATC Trace.

Reports at Split Transaction Level

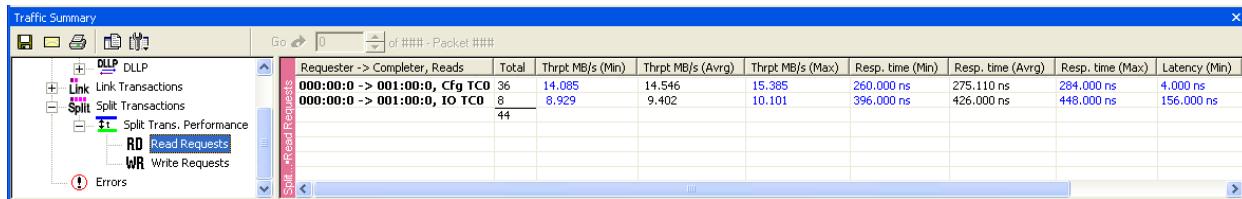
Split Transaction Performance: This report table groups the Split Transactions by Requester-Completer pair and displays Minimum/Average/Maximum data for Number Of Link Transactions and Response Time metrics.



The screenshot shows the PETracer Traffic Summary window with the 'Split Trans... Performance' report selected. The left pane shows a tree view of transaction types: All reports, Pkts, Link, Split, and Errors. The right pane displays a table with the following data:

Requester -> Completer	Total	# LinkTras (Min)	# LinkTras (Avrg)	# LinkTras (Max)	Resp. time (Min)	Resp. time (Avrg)	Resp. time (Max)
002:00:0 -> 000:04:0	188456	2	2.00	2	284.000 ns	448.040 ns	1.204 μs
000:04:0 -> 002:00:0	54	2	2.00	2	720.000 ns	802.880 ns	1.060 μs
		188510					

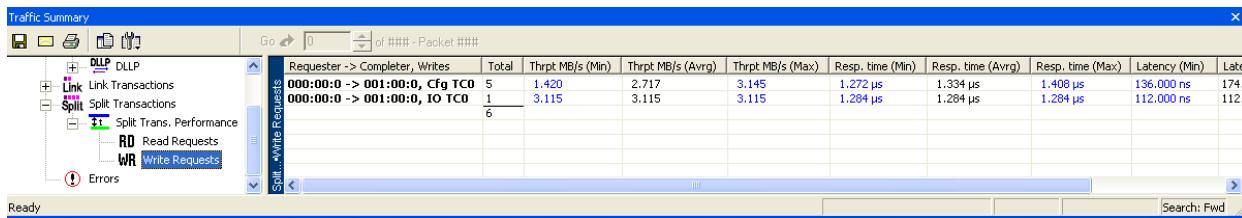
Read Requests Performance: This report table includes only the Split Transactions that present Read Requests (Configuration, IO and Memory). It groups them by the combination of Requester-Completer pair, request type, and Traffic Class and displays Minimum/Average/Maximum data for Throughput, Response Time, and Latency metrics.



The screenshot shows the PETracer Traffic Summary window with the 'Read Requests' report selected under the 'Split Trans. Performance' category. The left pane shows a tree view of transaction types: DLP, Link, Split, and Errors. The right pane displays a table with the following data:

Requester -> Completer, Reads	Total	Thrp. MB/s (Min)	Thrp. MB/s (Avrg)	Thrp. MB/s (Max)	Resp. time (Min)	Resp. time (Avrg)	Resp. time (Max)	Latency (Min)
000:00:0 -> 001:00:0, Cfg TCO	36	14.085	14.546	15.385	260.000 ns	275.110 ns	284.000 ns	4.000 ns
000:00:0 -> 001:00:0, IO TCO	8	8.929	9.402	10.101	396.000 ns	426.000 ns	448.000 ns	156.000 ns
	44							

Write Requests Performance: This report table includes only the Split Transactions that present Write Requests (Configuration and IO). It groups them by the combination of Requester-Completer pair, request type, and Traffic Class and displays Minimum/Average/Maximum data for Throughput, Response Time, and Latency metrics.



The screenshot shows the PETracer Traffic Summary window with the 'Write Requests' report selected under the 'Split Trans. Performance' category. The left pane shows a tree view of transaction types: DLP, Link, Split, and Errors. The right pane displays a table with the following data:

Requester -> Completer, Writes	Total	Thrp. MB/s (Min)	Thrp. MB/s (Avrg)	Thrp. MB/s (Max)	Resp. time (Min)	Resp. time (Avrg)	Resp. time (Max)	Latency (Min)
000:00:0 -> 001:00:0, Cfg TCO	5	1.420	2.717	3.145	1.272 μs	1.334 μs	1.408 μs	136.000 ns
000:00:0 -> 001:00:0, IO TCO	1	3.115	3.115	3.115	1.284 μs	1.284 μs	1.284 μs	112.000 ns
	6							

Reports at the Link Transaction Level

The following metric-based reports are displayed at the Link Transaction level:

Link Transaction Performance: This report table groups the Link Transactions by TLP Type and displays Minimum/Average/Maximum data for Number Of Packets, Response Time and Payload Bytes metrics.

This screenshot shows the PETracer Traffic Summary window with the 'Link Transaction Performance' report selected. The report table lists various transaction types along with their performance metrics. The columns include Transaction Type, Total, # Packets (Min), # Packets (Avrg), # Packets (Max), Resp. time (Min), Resp. time (Avrg), Resp. time (Max), Pld. Bytes (Min), Pld. Bytes (Avrg), and Pld. Bytes (Max). The data shows several entries for different transaction types like MWR(32), MRD(32), CplD, etc., with their respective statistics.

Transaction Type	Total	# Packets (Min)	# Packets (Avrg)	# Packets (Max)	Resp. time (Min)	Resp. time (Avrg)	Resp. time (Max)	Pld. Bytes (Min)	Pld. Bytes (Avrg)	Pld. Bytes (Max)
MWR(32)	1469	1	1.54	2	24.000 ns	135.390 ns	328.000 ns	1	3.98	4
MRD(32)	188514	1	1.31	3	20.000 ns	50.740 ns	304.000 ns	0	0.00	0
CplD	188510	1	1.26	2	24.000 ns	80.060 ns	388.000 ns	1	31.99	32
Msg	6	1	1.83	2	24.000 ns	129.330 ns	168.000 ns	0	0.00	0
MsgD	3	1	1.67	2	28.000 ns	210.660 ns	304.000 ns	0	0.00	0
	378502									

Memory Writes: This report table includes only the Link Transactions that present Memory Write Requests. Memory Writes are the only (posted) requests that don't get promoted to the Split transaction level, therefore their performance should be viewed at the Link transaction level. The table groups Memory Writes by the combination of Requester ID and Traffic Class and displays Minimum/Average/Maximum data for Response Time, Payload and Throughput metrics.

This screenshot shows the PETracer Traffic Summary window with the 'Memory Writes' report selected. The report table lists memory write transactions grouped by requester and traffic class. The columns include Requester, TC, Total, Resp. time (Min), Resp. time (Avrg), Resp. time (Max), Pld. Bytes (Min), Pld. Bytes (Avrg), Pld. Bytes (Max), Thrp. MB/s (Min), Thrp. MB/s (Avrg), and Thrp. MB/s (Max). The data shows two main entries for requester 001:00:0, TCD 20 and 11568, with their respective throughput statistics.

Requester, TC	Total	Resp. time (Min)	Resp. time (Avrg)	Resp. time (Max)	Pld. Bytes (Min)	Pld. Bytes (Avrg)	Pld. Bytes (Max)	Thrp. MB/s (Min)	Thrp. MB/s (Avrg)	Thrp. MB/s (Max)
001:00:0, TCD 20	112.000 ns	297.390 ns	564.000 ns	8	8.00	8	14.184	32.079	71.429	
000:00:0, TCD 11568	296.000 ns	570.110 ns	816.000 ns	4	50.59	64	6.579	84.421	124.031	
	11588									

Following features apply to all of the report tables described above for the Split Transaction and Link Transaction levels:

- Each report row for the defined tables contains the total number of units in this group for the CATC Trace (total number of units for Split Transaction performance, Read Requests performance, Memory Writes, and so on).
- In many cases, the Maximum and Minimum values in the report tables are navigable. By clicking table cells, you reposition the corresponding CATC Trace view to the Split or Link Transaction that has yielded this maximum or minimum value. This can help you to find specific units in the CATC Trace, such as transactions that produced spikes in Response Time or Throughput.

Show Metrics in the Bus Utilization Window

The Bus Utilization window provides graphs for packet-level information in the CATC Trace. The window also provides graphs for information on Split and Link Transaction levels, plotted over time. The graphs for Split and Link Transaction levels are based on metrics collected for the transactions throughout the CATC Trace.

The seven graphs related to Split and Transaction levels are:

1. Pending Requests at Split Transaction level.
2. Response Time at Split Transaction level.
3. Latency Time at Split Transaction level.
4. Throughput Per Transaction at Split Transaction level.
5. Response Time and Latency Time at Split Transaction level (combined graph).
6. Response Time at Link Transaction level, for Memory Writes only.
7. Throughput at Link Transaction level, for Memory Writes only.

The following is an example of Bus Utilization window display of graph numbers 1, 4, 5, 6 and 7:



Unit-Based Averaging

The Analyzer builds metric graphs using unit-based averaging (as opposed to time-based averaging). For the total duration of a certain request (or Memory Write transaction), the graph value is assumed equal to the corresponding metric for this request (transaction). If there are overlapping operations for a certain time period, then the value is calculated as an average of metric values for all the overlapped requests (transactions).

It is important to remember that the Analyzer uses unit-based averaging rather than time-based averaging. Time-based averaging can be misleading in some situations. For example, consider the Throughput Per Transaction graph. Sometimes, while many outstanding requests are in progress, latency (and response time) grows for each of the transactions, resulting in a lower throughput per transaction over time (which is reflected in the graph). This happens even though aggregated throughput across all the transactions is constant.

Bus Utilization Window Features

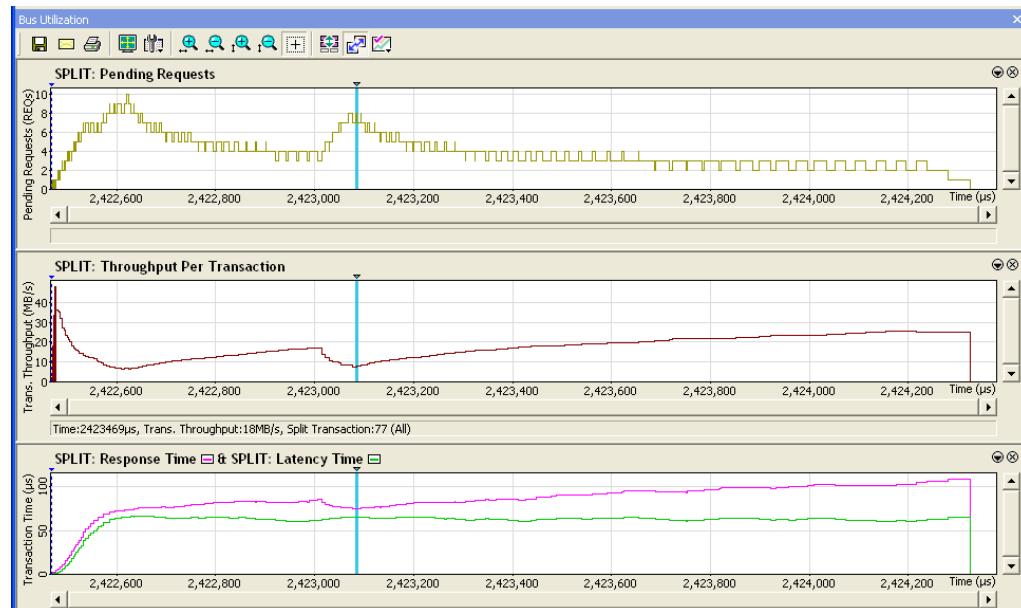
For the seven Split- and Transaction-level graphs listed, all Bus Utilization window features are available, such as zooming in/out, changing scale type, scrolling, context-sensitive status, and graph synchronization. See Bus Utilization and Bus Utilization Buttons for more on these features.

Note: Clicking a certain place within a graph area repositions the CATC Trace display at the Link or Split transaction level to the transaction that was in progress at that time.

Split Transaction Level Graphs

Transactions at the Split level combine all the non-posted requests with corresponding completions. This includes Configuration and IO Read and Write requests, as well as Memory Read requests.

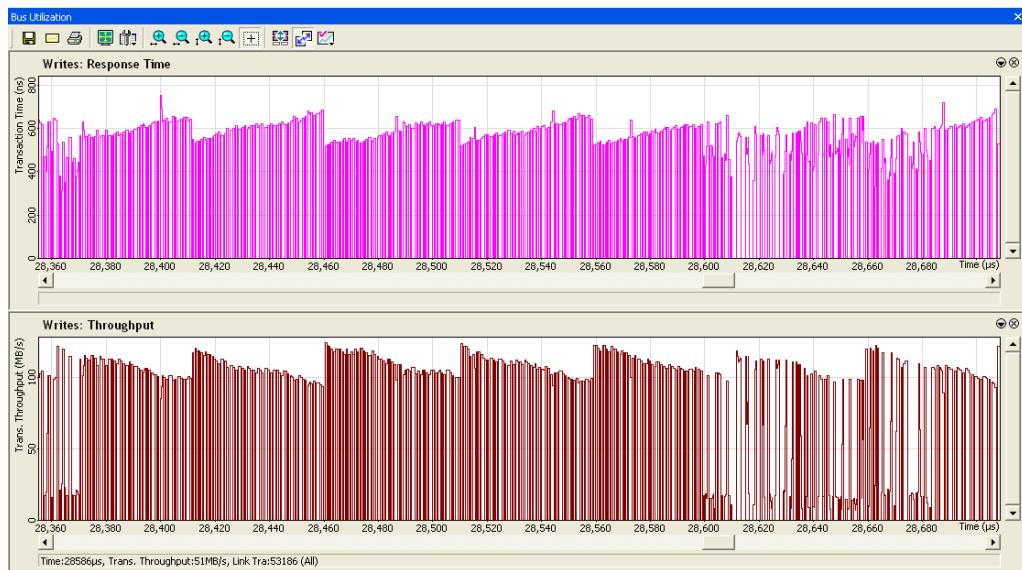
The following shows the graphs for the Split level:



Note: The Pending Requests graph is not directly defined by metrics, but it is useful when considering metrics. The Pending Requests graph presents the unit-averaged number of requests that were pending (in progress) at any moment of time. It allows you to correlate the number of requests posted to a completer with other performance metrics.

Link Transaction Level Graphs

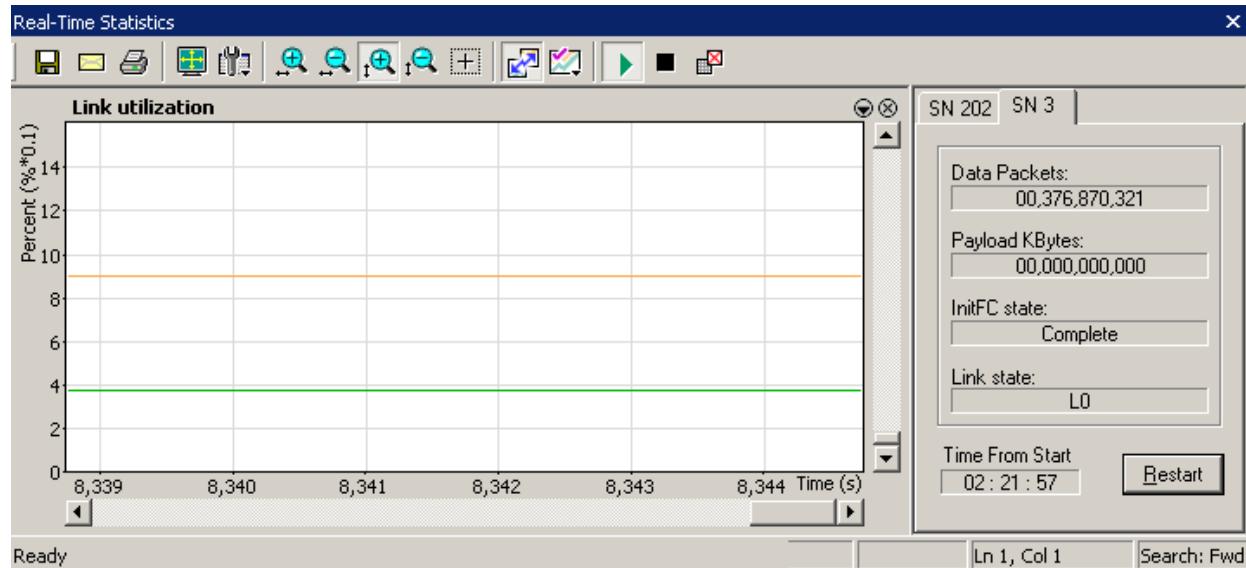
Memory Writes are the only (posted) requests that do not get promoted to the Split transaction level. Therefore, Memory Write performance should be viewed at the Link Transaction level. That is the reason graphs at the Link level only present the Memory Write-related metrics and are titled **Writes: Response Time:** and **Writes: Throughput.**



9.13 Real-Time Statistics Window

The Real-Time Statistics Window displays Link Utilization, performance measurements, and statistical values for a PCI Express link plotted in real time.

Click  to open the Real-Time Statistics window.



Start PCI Express™ link activity.

To start the monitor, press .

To stop the monitor, press .

The remaining Real-Time Statistics buttons provide options for changing the format of the display.

Additional formatting options are available through the Real-Time Statistics pop-up menu and the Real-Time Statistics toolbar.

Real-Time Statistics Buttons

Additional formatting options are available through the Real-Time Statistics toolbar.



Button	Function
	Save. Saves Real-Time Statistics data to bitmap file (*.bmp).
	Email. Opens an email and attaches a bitmap file of the Real-Time Statistics data.
	Print. Prints the Real-Time Statistics data.
	Full Screen. Maximizes the Real-Time Statistics window.
	View Settings. Opens a sub-menu with the following choices: <ul style="list-style-type: none">• Orient Horizontally• Tile Vertically• Show Markers• Show Plumbline• Status >><ul style="list-style-type: none">BarTool tipsNone• Grid Lines >><ul style="list-style-type: none">Both AxesX AxisY AxisNo Grid• Grid on Top• Fonts & Colors
	Horizontal zoom in
	Horizontal zoom out



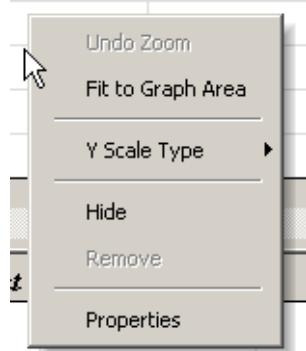
- Orient Horizontally
- Tile Vertically
- Show Markers
- Show Plumbline
- Status >>
 - Bar
 - Tool tips
 - None
- Grid Lines >>
 - Both Axes
 - X Axis
 - Y Axis
 - No Grid
- Grid on Top
- Fonts & Colors



-  Vertical zoom in
-  Vertical zoom out
-  Click and Drag Zoom. Click and drag to zoom in on a part of the graph.
-  Synchronize Graph Areas. If two or more graphs are displayed, this button synchronizes the graphs to one another. Once synchronized, the positioning slider of one graph moves the other graphs.
-  Graph Areas. Allows you to hide or display the graphs and the counters. You can toggle Statistics Accumulation, Link Utilization, Data Payload Throughput, and Data Packet Count.
-  Start real-time statistics. Starts the real-time statistical monitor.
-  Stop real-time statistics. Stops the real-time statistical monitor.
-  Reset Graphs. Resets the graphs.

Real-Time Statistical Monitor Pop-up Menu

Additional formatting options are available through the Real-Time Statistics pop-up menu. Right-click a graph in the Real-Time Statistical Monitor window to display a pop-up menu with options for changing the format of the display.



Undo Zoom: If you have zoomed in, this command undoes the zoom.

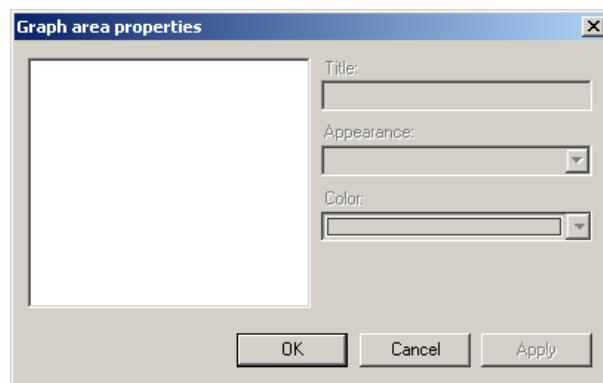
Fit to Graph Area: Redisplays graph so that the entire CATC Trace fits inside graph area.

Y Scale Type:

- **Linear:** Converts display to linear format.
- **Logarithmic:** Converts display to logarithmic format.

Hide: Hides the selected graph

Properties: Opens a dialog box with options for changing the Title, Appearance, and Color of the graph.



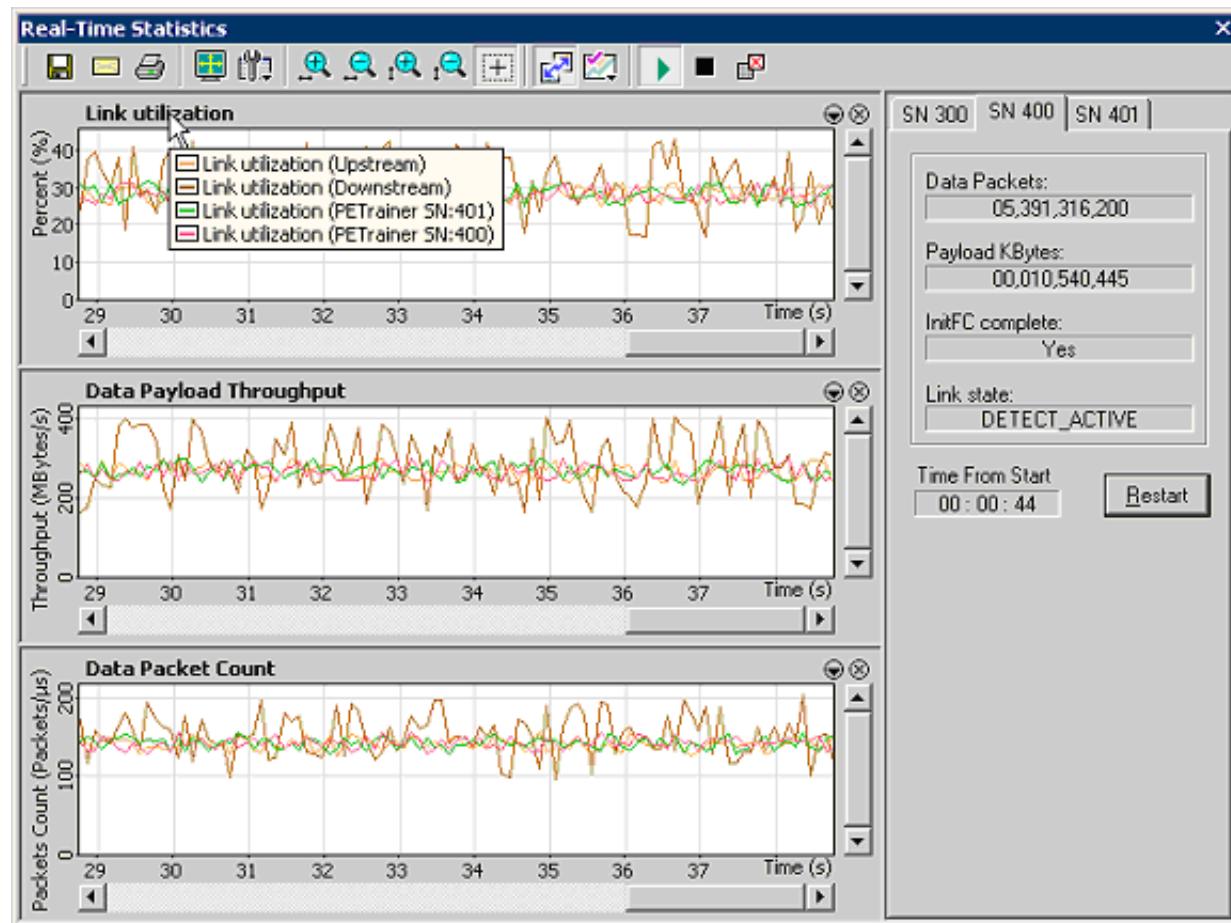
Real-Time Statistics Graph Areas

The Real-time Statistics window has three graph areas:

- Link Utilization
- Data Payload Throughput
- Data Packet Count

Each graph area has Upstream and Downstream graphs for a PETracer device (if connected to a PC), plus as many graphs as PETrainer™ devices connected to the PC.

The Statistics Accumulation area shows the PETracer statistics tab, plus as many tabs as PETrainer devices connected:



For each PETrainer device the following information displayed:

- **Number of data packets**
- **Payload size**
- **InitFC complete status:** Yes/No
- **Link State:** Possible states are:
 - DETECT QUIET
 - DETECT ACTIVE
 - POLLING ACTIVE
 - POLLING CONFIG
 - CONFIG_LINKWIDTH_START
 - CONFIG_LINKWIDTH_ACCEPT
 - CONFIG_LANENUM_WAIT
 - CONFIG_LANENUM_ACCEPT
 - CONFIG_COMPLETE
 - CONFIG_IDLE
 - L0
 - L0S_IDLE
 - L0S_FTS
 - L1
 - RECOVERY_RCVRLOCK
 - RECOVERY_RCVRCFG
 - RECOVERY_IDLE
 - HOT_RESET
 - DISABLED

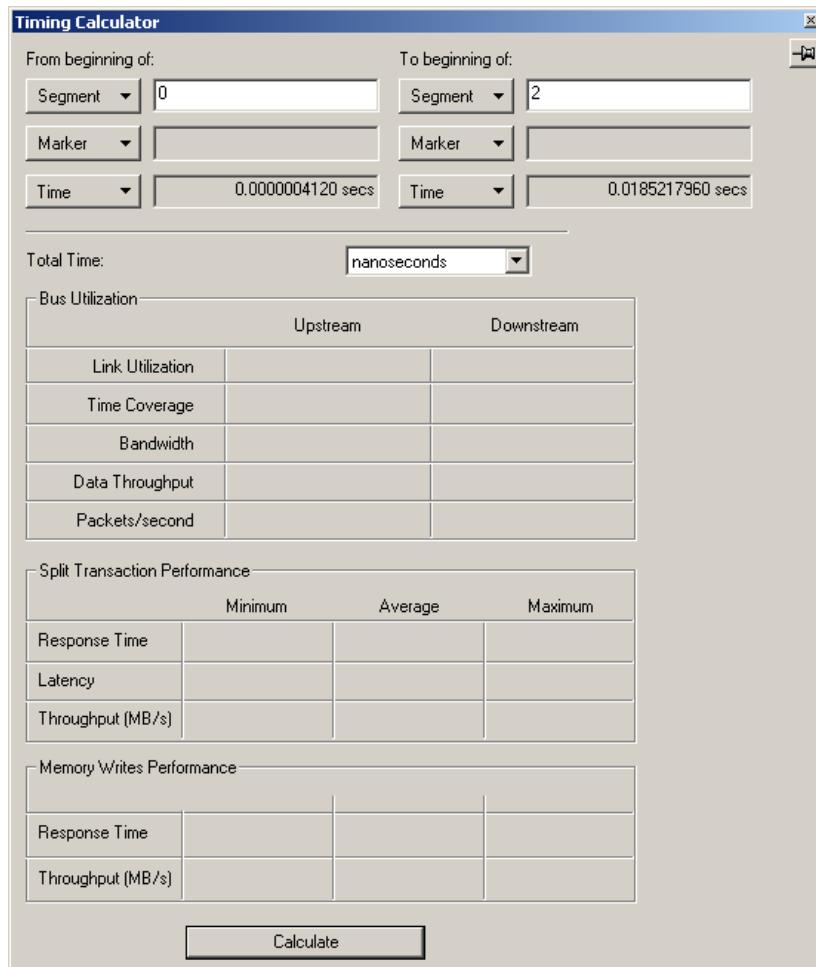
9.14 TC to VC Mapping

TC to VC Mapping displays how Traffic Classes are mapped to Virtual Channels (to simplify navigation) and how the CATC Trace display was changed (for example, in Split Transactions).

9.15 Timing and Bus Usage Calculations

The Timing and Bus Usage Calculator allows you to calculate time between packets.

Select **Reports > Timing Calculations** to obtain the Timing Calculator dialog box.



Total Time: Total time from beginning of the first unit to beginning of the second unit.

Bus Utilization

This portion of the Timing Calculator window gives values that are cumulative for all packets during the timing period. For example, throughput is combined throughput of all packets during the timing period.

Upstream is from endpoint devices to the root complex. Downstream is from the root complex to endpoint devices.

Link Utilization: Percentage of non-idle symbols in total number of symbols transferred.

Time Coverage: Percentage of non-idle symbol times in total number of symbol times. (Non-idle symbol time occurs when at least on one of the lanes there were non-idle symbols transferred.)

Bandwidth: Number of non-idle symbol bits transferred per second.

Data Throughput: Number of TLP payload bytes transferred per second.

Packets/second: Number of packets transferred per second.

Split Transaction Performance

This portion of the Timing Calculator window gives minimum, maximum, and average values for all Split transactions during the timing period. For example, minimum throughput is throughput of the Split transaction that passes the least amount of data. Maximum throughput is throughput of the Split transaction that passes the most amount of data. Average throughput is the average calculated for all Split transactions during the timing period.

Response Time: The time it took to transmit this Split transaction on the PE link, from the beginning of the first packet in the Split transaction to the end of the last packet in the Split transaction.

Latency: The time measured from the end of the request transaction to the first completion transmitted in response to the request within this Split transaction.

Throughput: The transaction payload divided by response time, expressed in megabytes per second.

Memory Writes Performance

This portion of the Timing Calculator window gives minimum, maximum, and average values for all Memory Write transactions during the timing period. For example, minimum throughput is throughput of the Memory Write transaction that passes the least amount of data. Maximum throughput is throughput of the Memory Write transaction that passes the most amount of data. Average throughput is the average calculated for all Memory Write transactions during the timing period.

Response Time: The time it took to transmit this Memory Write on the PE link, from the beginning of the first packet in the Memory Write to the end of the last packet in the Memory Write.

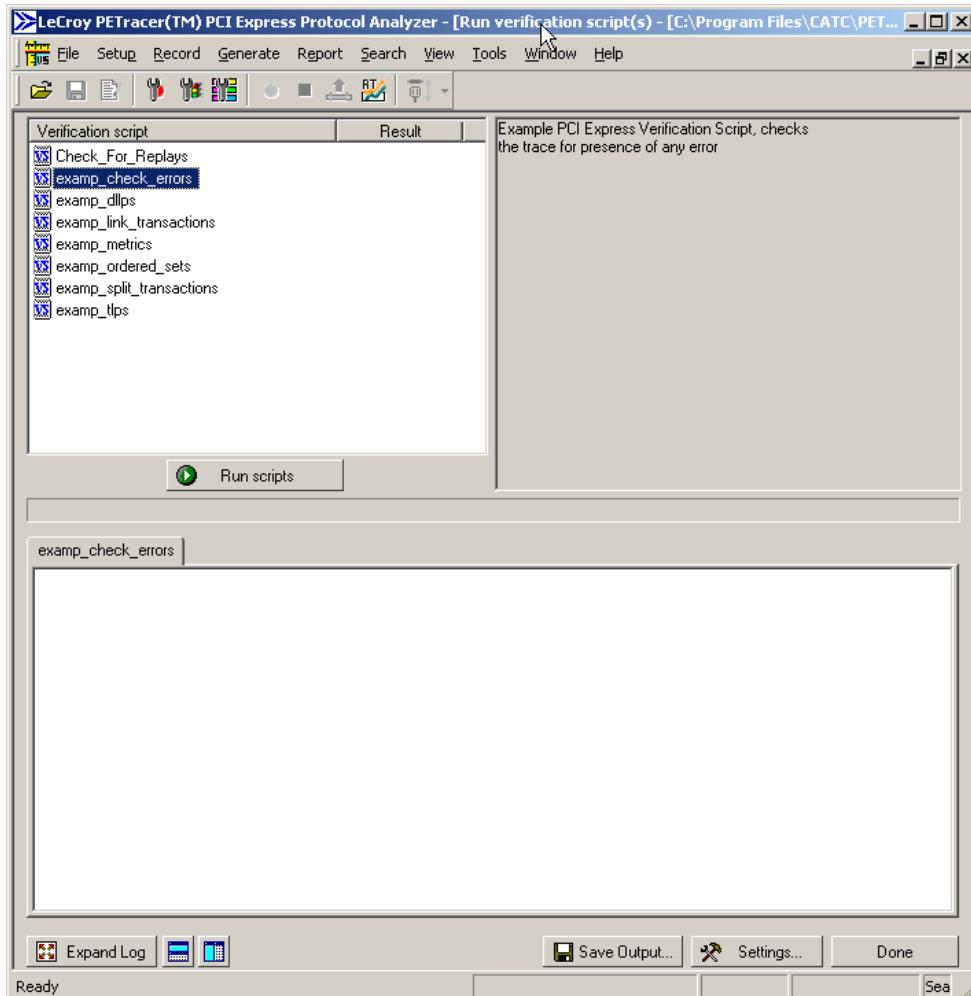
Throughput: The Memory Write payload divided by response time, expressed in megabytes per second.

9.16 Running Verification Scripts

You can run verification scripts to check errors, link transactions, split transactions, metrics, ordered sets, replays, DLLPs, and TLPs.

To obtain the Verification Script dialog box, select **Tools > Run verification scripts**

or click the  icon.

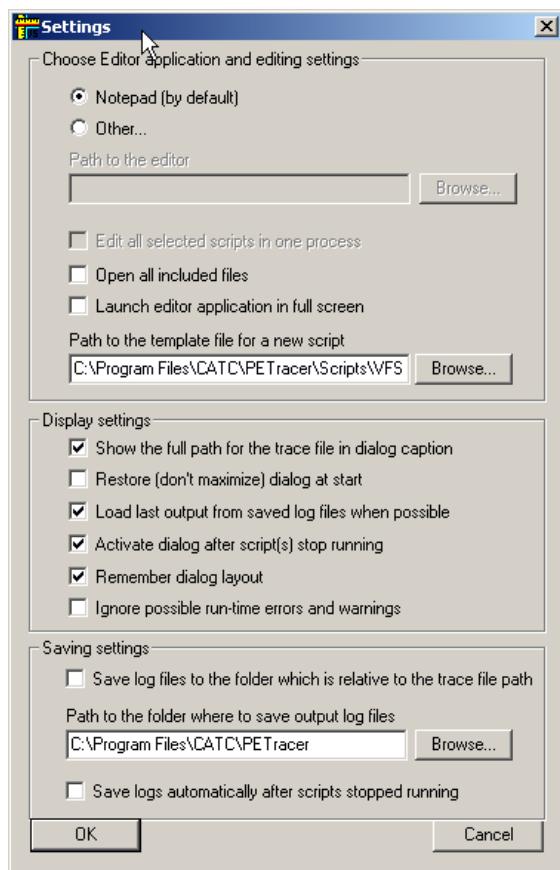


The available verification scripts are in the Verification script section.

To run a script, select it, then click the **Run Scripts** button .

The results appear in the bottom window. You can expand or collapse this window. You find a view related to the CATC Trace and place this window under or to the right of it. You can Save the results.

Click the **Settings** button to display the Settings window.



You can choose the editor, display settings, and saving settings.

Section 3. PETrainer Exerciser Traffic Generation

Chapter 10: Traffic Generation

PETrainer™ is a traffic generator that can emulate PCI Express™ root complexes and endpoint devices. Traffic generation can be used to transmit known errors, allowing you to observe how your device handles faulty link conditions.

After the *PETrainer EML™* and DUT have been cabled and powered on, you can test the setup by generating some traffic. The following steps show how to configure the Exerciser to generate a Link Training sequence.

10.1 Theory of Operation

Overview

PETrainer offers two mechanisms for implementing traffic generation: scripts, in which any type of traffic can be defined and executed, and the Generation Options dialog box, which offers a collection of PCI Express specific **behaviors** that can be enabled for automatic generation of traffic.

Using scripts, packets can be transmitted one after another or with certain timing or event-based pauses between them. This allows the *PETrainer* to act as a pattern generator with PCI Express-specific formatting and transmission rates. However, creating traffic that emulates real devices with relatively complex protocol behaviors using a simple pattern generator is quite complicated. Certain behaviors such as ACK policies, and flow control require concurrent processing. This is where the automated features of the *PETrainer EML™* products become useful.

The *PETrainer* includes a collection of automated traffic generation circuits that commonly exist in other PCI Express devices. These circuits include ACK/NAK generation, flow control management, a Link Training and Status State machine (LTSSM), replay buffers, and transaction timers. What makes the *PETrainer* unique and so useful is that each of these behaviors can be individually modified or disabled. This allows the user to perform operations that might not otherwise be possible using an off the shelf PCI Express device. This can be particularly useful when doing compliance or fault recovery testing.

Starting Point

When the *PETrainer* first powers up, it is at electrical idle on all lanes. The link is not trained, but the Link Training and Status State Machine (LTSSM) is enabled and waiting for a command to train the link. To begin communication with a PCI Express device, the Link training must occur, but first the generation settings must be set. This involves setting the Link parameters such as link width, polarity inversion, and lane reversal, through the Generation Options dialog.

Note: Setting the options in the Generation Options dialog has no effect on the *PETrainer* behavior until the first script is executed. In fact, each time a script is executed, these behaviors are reprogrammed to the *PETrainer* and the behaviors are modified accordingly.

The **Link Connect** toolbar button can then be pressed to signal to the LTSSM to initiate Link training. Alternatively, a script can be executed with the **Link=L0** command.

The PETrainer Status bar at the bottom of the screen shows the current state of the PCI Express Link. When the Link is down, it shows **Detect**. When it is up, it shows **L0**.

All of the intermediate link states, such as **Polling** and **Configuration**, are handled automatically. In fact, after the **Link=L0** command is executed and the LTSSM is alive, the PETrainer attempts to keep the Link active just as any other PCI Express device does. This includes handling of Recovery states and subsequent retraining events.

The next step is to enable flow control. This is done by executing the **Link=InitFC** command. This causes PETrainer to perform flow control initialization and, if enabled, begin periodic transmission of **Update_FC DLLP**'s. If the Link connect toolbar button was used, the flow control initialization happens automatically.

By using these basic commands, the complicated process of link training is managed automatically. The Link is now trained and the script execution can now focus on sending TLP packets.

Script Execution

As mentioned above, each time a script is executed, the configuration settings for the PETrainer are reprogrammed. When the **Start generation** button is pressed, the script is uploaded to the PETrainer hardware and executed immediately. Progress of the script can be tracked in the status bar at the bottom of the screen. Subsequent executions of the same script do not require upload of the script to the PETrainer, however, as mentioned above, the generation options are still reprogrammed.

Script execution can be throttled using **Wait** commands inserted directly into the script. Waits can be time based, require receipt of certain packet types, or can even require **User** input from the GUI.

After the script is complete, any enabled PCI Express **behaviors**, such as SKIP insertion, Flow control, and ACK generation, continue. This allows you to run multiple scripts, one after another, without interrupting the Link state.

10.1 Traffic Generation Files

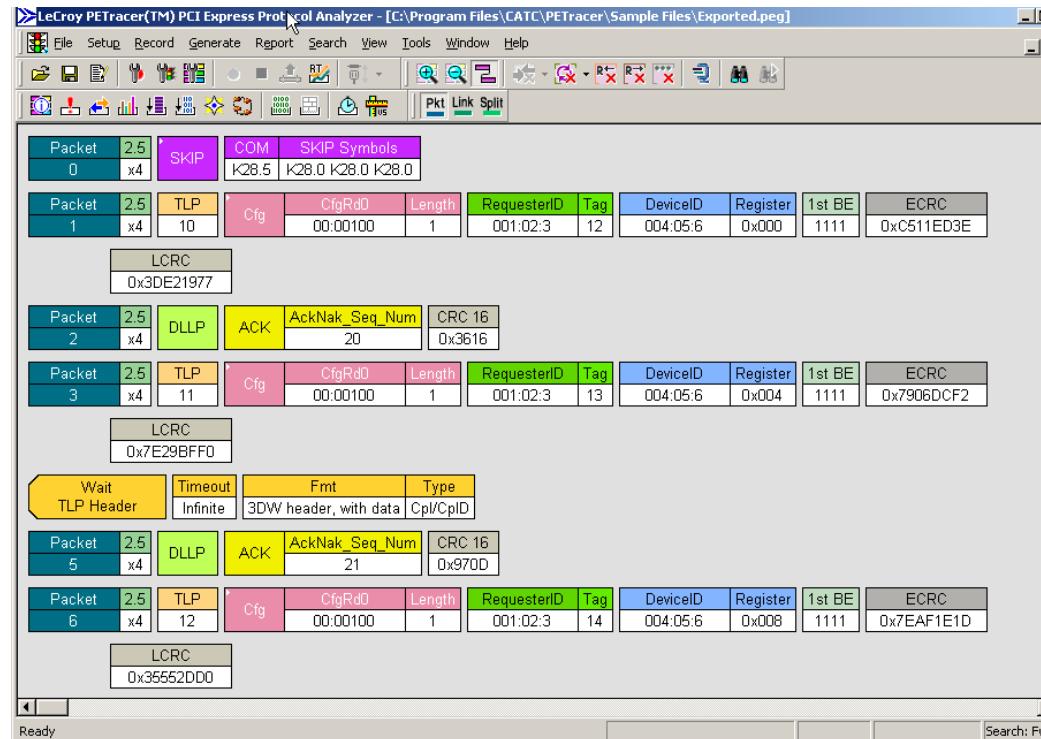
The **.peg** traffic generation files are text files consisting of a series of commands from a scripting language (see Chapter 12), and optionally, one or more **Include** statements linking other generation files into the current file.

```

1  packet = OrderedSet {
2    SetType = Skip
3    SkipCount = 0x3
4  }
5  packet = TLP {
6    PSN = 0xA
7    TLPType = CfgRd0
8    TC = 0x0
9    TD = 0x1
10   EP = 0x0
11   Ordering = 0x0
12   Snoop = 0x0
13   Length = 0x1
14   RequesterID = (1:2:3)
15   Tag = 0xC
16   LastDwBe = 0x1
17   FirstDwBe = 0xF
18   DeviceID = (4:5:6)
19   Register = 0x0
20   ECRC = 0xC511ED3E
21   LCRC = 0x3DE21977
22 }
```

Note: To edit a generation file, use the Script Editor, a specially designed text editor tool. See “Editing Generation Files with the Script Editor” on page 192.

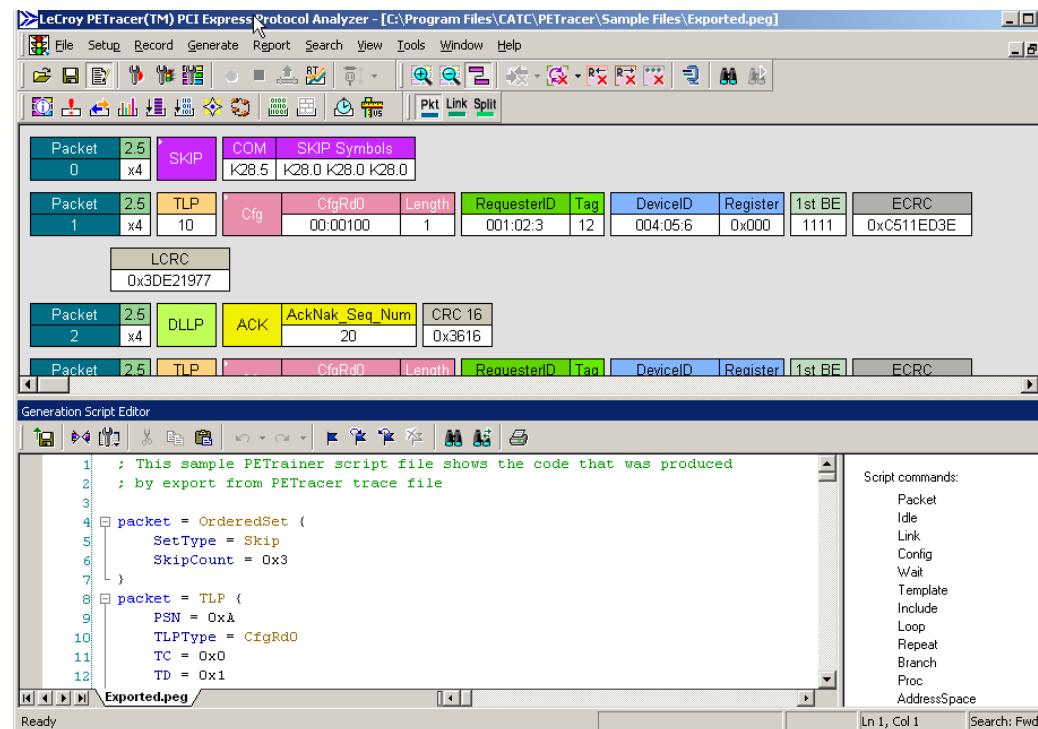
To generate traffic, open a traffic generation file (***.peg**) and then run it.



When the file is opened, it appears in the CATC Trace window looking like a CATC Trace file.

To run the file, press .

To create or edit a .peg file, use the Script Editor.



The Script Editor is a text-editing tool that can be opened by clicking .

Alternatively, the traffic generation file can be created by exporting the data from a CATC Trace into a traffic generator file.

10.2 Creating a Traffic Generation File

There are four ways to create PETracer™ traffic generation script file:

- **Export an existing PETracer™ trace** to a PETracer script file
- **Save an existing PETrainer script** to a new file
- **Select File > New** to create a new and empty script file that contains no text.
- **Create an empty file** using an OS shell (with .peg extension) and open it with PETracer software.

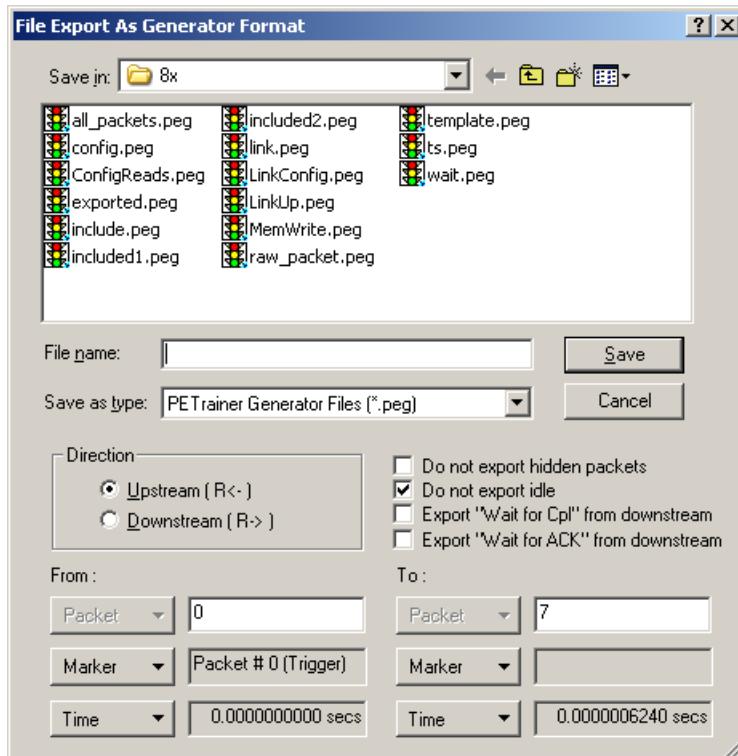
Exporting a CATC Trace to a Traffic Generation File

A simple way to create a script file is to open a CATC Trace and then to export the CATC Trace data to a generation file:

Step 1 Open a CATC Trace file.

Step 2 Select **File > Export > to Generator File Format**.

Step 3 Select the desired options from the File Export dialog box:



Direction: Selects the direction of the traffic to be exported.

From and To: Selects a range for exporting. You can export all or part of the CATC Trace.

Do not export hidden packets: Ignores any packets hidden through the various hide options.

Do not export Idle packets: Excludes Idles from the export.

Export "Wait for Cpl" from upstream: Exports all **Wait for Completions** from the opposite direction. **Wait = TLP** is a PETrainer script command.

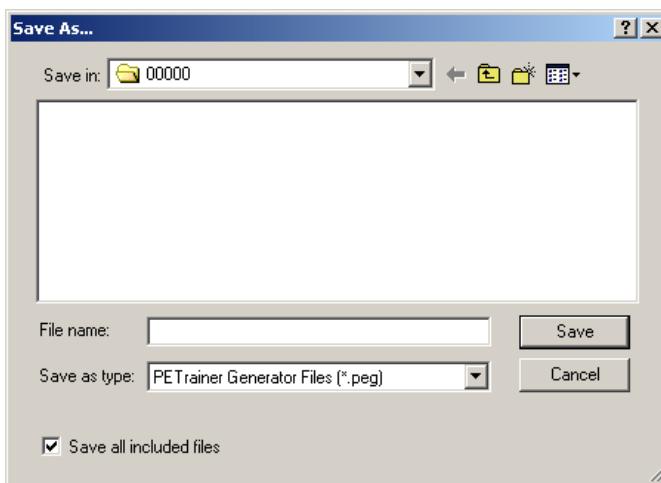
Export "Wait for ACK" from upstream: Exports all **Wait for ACK DLLPs** from the opposite direction.

Saving a PETrainer Script to a New File

To save a script file as a generation file:

Step 1 Open an existing PETrainer script file.

Step 2 Select **File > Save As...** or click  on the toolbar.



Step 3 Navigate to the desired folder and type a new file name where you want to save the current script, then click the **Save** button:

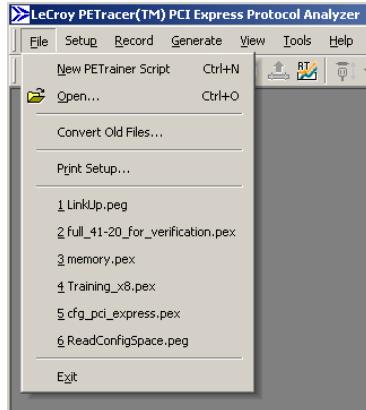
When the Save As command completes, the newly created script is displayed.

Note: The Save As dialog box includes the option **Save all included files**. This option causes the software to save any **Include** files that have included into the script. The Included files are saved to the same directory as the traffic generation file.

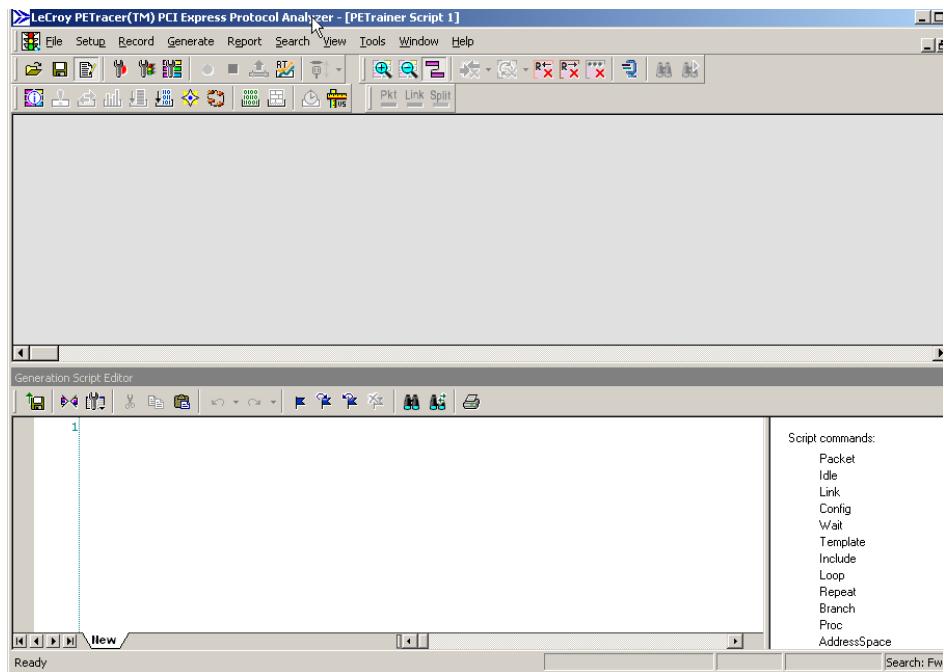
Creating a New Empty Generation File

To create a generation file from scratch:

Step 1 Select **File > New PETrainer Script** or use the shortcut **Ctrl+N**.



An empty PETrainer traffic generation file appears. You can also view the Script Editor.

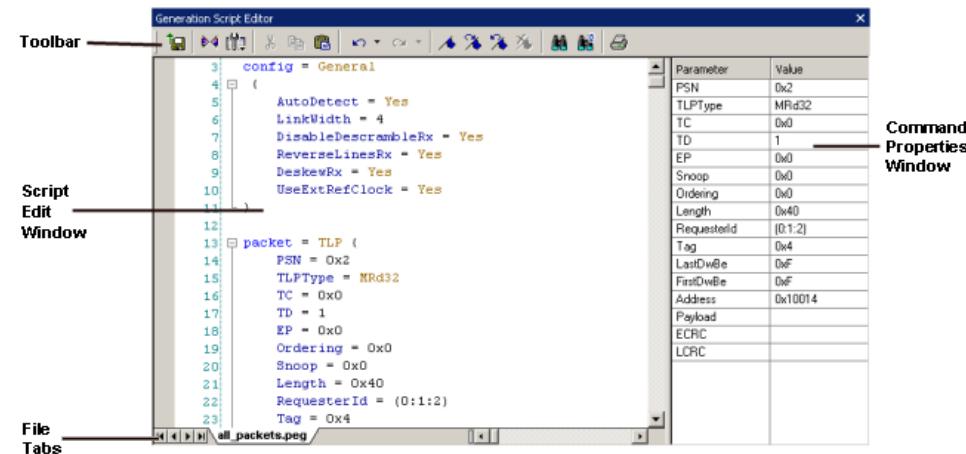


10.3 Editing Generation Files with the Script Editor

The Script Editor is an editing tool for PETracer traffic generation files (`<filename>.peg`). The generation script is presented in the Script Edit window. Parameters are presented in menus and text boxes in the Command Properties window in the right-hand portion of the Script Editor.

To launch the Script Editor: click the **Script Editor** button  on the toolbar or right-click the CATC Trace window and choose **Edit as Text** from the pop-up menu.

The Script Editor window displays in the lower portion of the CATC Trace window.



Layout: The Script Editor divides into four areas:

- **Script Editor toolbar:** Presents options for printing, saving, bookmarking, and other options.
- **Script Edit window:** Main window where the script is displayed and edited. Text in this window behaves as in most text editors. Text can be copied, pasted, and searched.
- **Command Properties window:** Presents editable parameters. Many parameters have menus. Click the parameter in the Command Properties window to see if a down-arrow appears.
- **File tabs:** Lists the name of the traffic generation file and any open **Include** files that are associated with the generation file. If the generation file has **Include** statements, the **Include** files automatically open and display as tabs in the File tabs section of the Editor window.

Error Log: An error log opens automatically at the bottom of the window any time a script error occurs. The window closes automatically whenever the error is corrected, after you save the script.

Script Editor Toolbar

The toolbar contains buttons for saving your edits, navigating, searching and other functions.



Save. Saves your edits and immediately updates the setting bars and Frames shown in the CATC Trace window.



Go to Trace View.
Causes trace view to bring the currently selected script line to the top of the screen.



Toggle Bookmark. Allows markers to be set or removed to aid in navigation.



View Options. Opens a menu with three options:

- Enable Outlining
- Toggle Outlining
- Line Numbers.

See “View Options Menu” on page 198 for descriptions.



Next Bookmark.



Cut.



Previous Bookmark.



Copy.



Clear All Bookmarks.



Paste.



Find.



Undo.



Replace. Find and replace.



Redo.



Print.

Script Edit Window

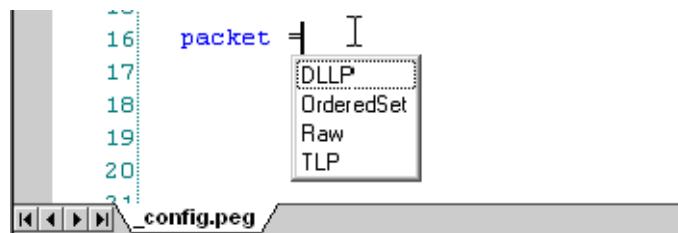
The Script Edit Window offers several features to simplify the process of editing.

Syntax Highlighting

All known commands and parameters are highlighted in **blue**.

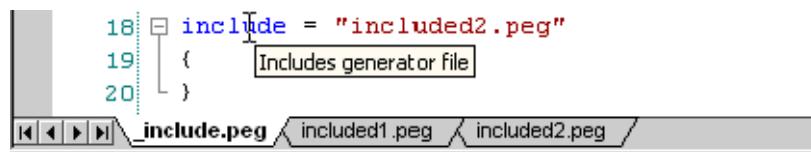
All predefined values and command modifiers are highlighted in **brown**.

Intellisense prompts for known predefined values/literals. This functionality is invoked when you type = after a known key or select **List values** from the Context menu.



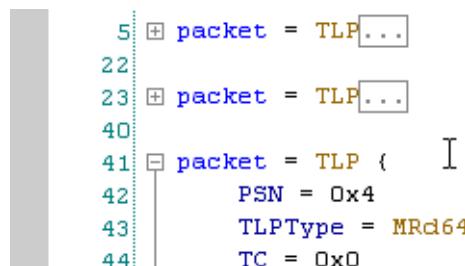
Tooltips

The Tooltips look like the following:



Outlining

When outlining is enabled user have the option to **collapse/expand** code blocks:



Text Editing Commands

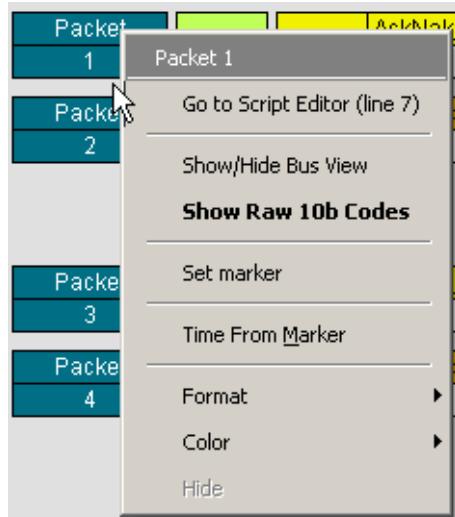
The Script Editor supports standard editor commands:

- Copy/Paste
- Undo/Redo
- Find/Replace
- Bookmarks

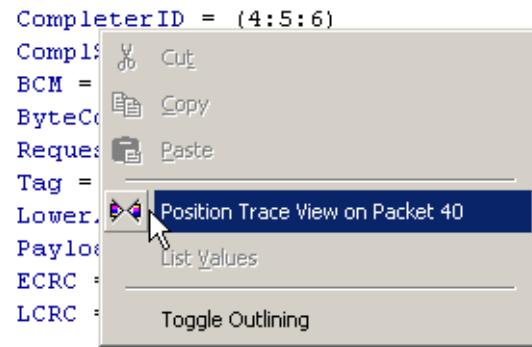
Synchronized Scrolling with the CATC Trace Window

You can navigate from the generation code window to the corresponding place in the CATC Trace representation, and visa versa.

From the CATC Trace window, right-click the **first cell in a packet** in the CATC Trace window and select **Go to Script Editor** from the pop-up menu. The Script Editor window then repositions to the corresponding code.

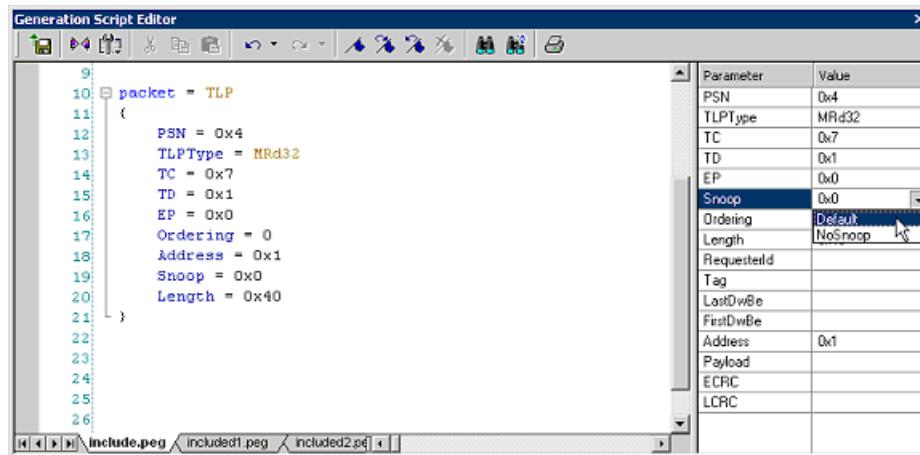


From the script editor, right-click some **code** within the Script Editor window and select **Position Trace view on packet x** from the pop-up menu (where **x** is a packet number). The CATC Trace window repositions to the corresponding packet number.

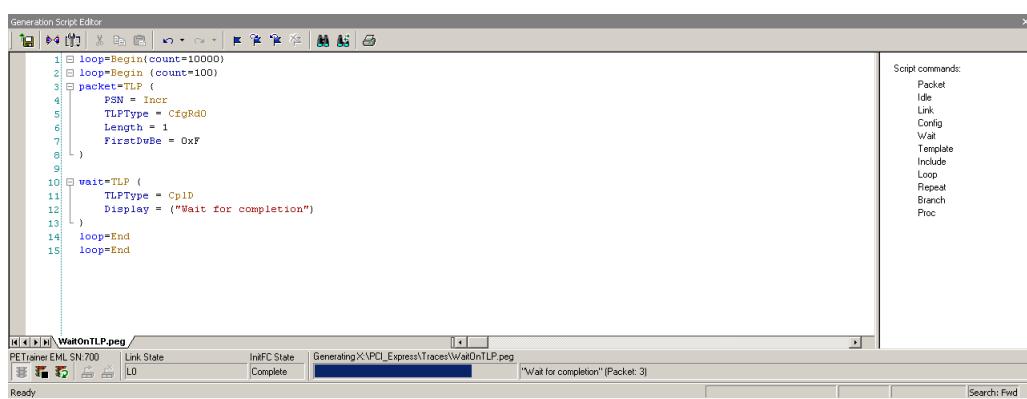
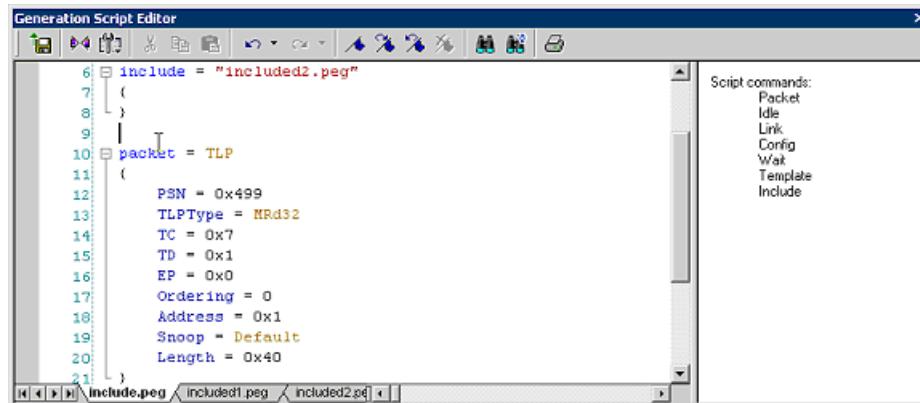


Command Properties Window

The Command Properties window lists all possible parameters for the current script command and all values for the parameters currently defined in this command. Entering parameters/values within the Edit window causes the Command Properties window to automatically update. Parameters/values can be changed by entering text into the text boxes or by selecting items from pull-down menus as shown in the example below.



In this case, the edit window is updated automatically. If the current script command does not have parameters or the current cursor position is outside of any script command, then a generic prompt is displayed in the window:



Script Editor File Tabs

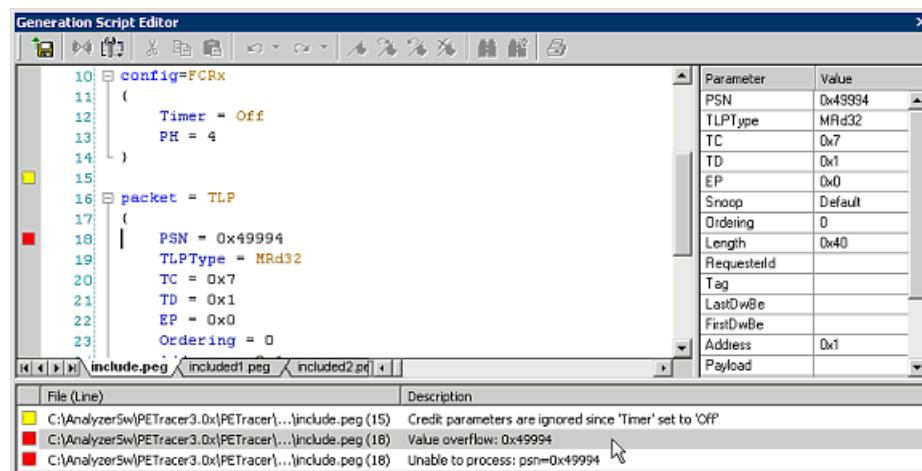
At the bottom of the Script Editor window is the name of the open generation file.

If there are **Include** statements in the generation file that link it to other generation files, these files automatically open and display as tabs at the bottom of the window. You can click the tabs to toggle between the open generation files.



Script Editor Error Log

Whenever you create a scripting error, a log opens at the bottom of the application window. When the error is corrected, the window automatically closes.



Errors: Marked by red squares.

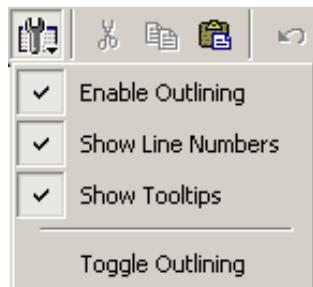
Warnings: Marked by yellow squares.

Double-clicking an error in the error log causes the cursor in the edit window to move to where the error was detected.

Note: You cannot run the script if it has syntax errors.

View Options Menu

The **View Options** button displays a menu with these options:



Enable Outlining: Adds an expandable/collapsible tree structure to the left side of the Script Editor showing the hierarchical relationships of the script lines.

Show Line Numbers: Adds line numbers to the left side of the Script Editor window.

Show Tooltips: Allows tooltip popups, which provide descriptions of script keywords when cursor mouses over a keyword.

Toggle Outlining: Toggles the outline tree between collapsed and expanded states.

10.4 Generation Options Dialogs Overview

The Generation Options dialog box is used to set Config settings in a traffic generation script (for example, **Config = General** or **Config = Link**). This dialog duplicates the **Config** script command and is provided as a convenient alternative means of setting this command in the script.

Note: The Generation Options dialog is subordinate to the script itself, so script commands override options selected in this dialog box.

Opening the Dialog

To open the Generation Options dialog, select **Setup > Generation Options** or click

the **Generation Options** button .

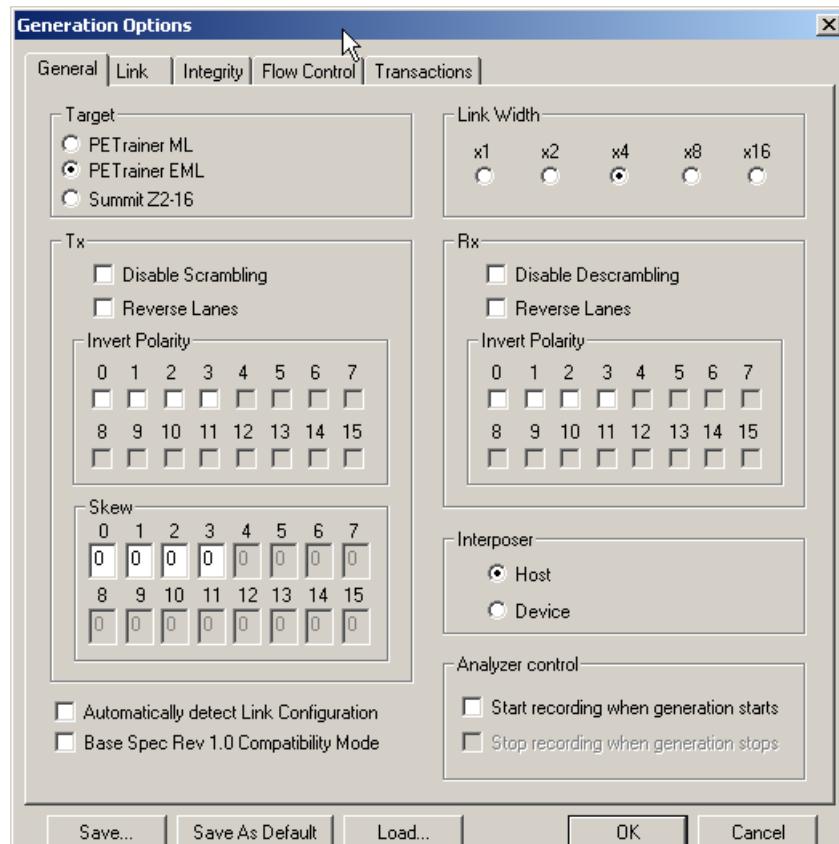
Dialog Layout

The Generation Options dialog is organized into five pages: General, Link, Integrity, Flow Control, and Transactions.



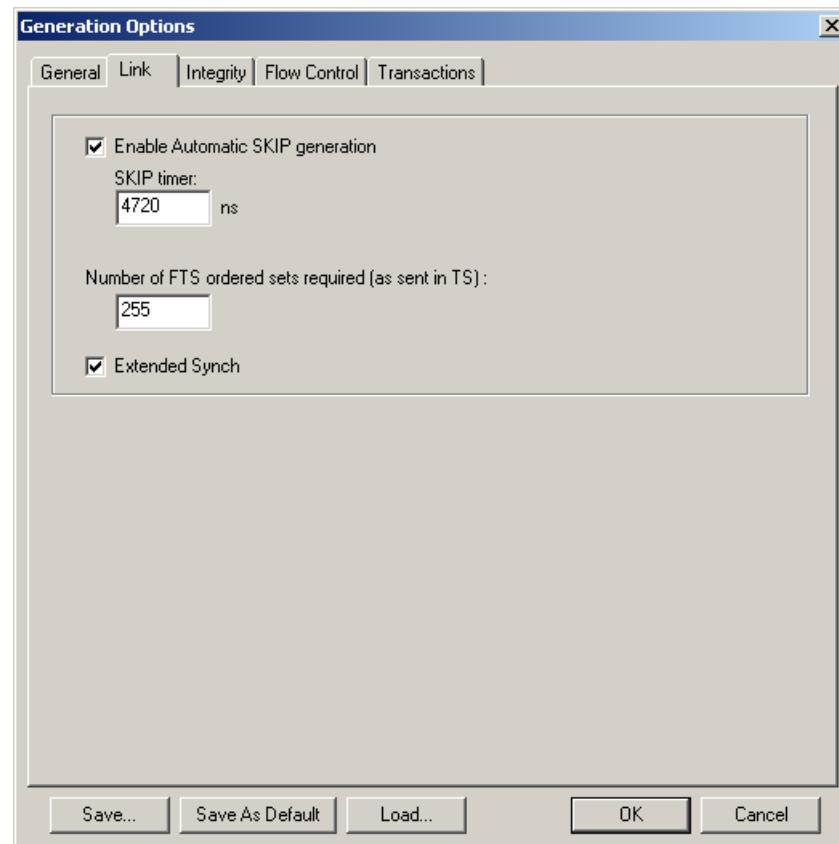
10.5 Generation Options for PETrainer EML

General



Parameter	Values	Default	Comment
Target			Specifies the generation platform. The choice affects some of the options presented in the Generation Options dialog.
LinkWidth	1 2 4 8 16	1	Ignored if AutoDetect is set.
DisableScrambleTx	Yes No	No	Ignored if AutoDetect is set.
DisableDescrambleRx	Yes No	No	Ignored if AutoDetect is set.
ReverseLanesTx	Yes No	No	Ignored if AutoDetect is set.
ReverseLanesRx	Yes No	No	Ignored if AutoDetect is set.
InvertPolarityTx	(X,X,X,X)		Ignored if AutoDetect is set.
InvertPolarityRx	(X,X,X,X)		Ignored if AutoDetect is set.
SkewTx	(X,X,X,X)		
Interposer	Host Device	Host	Host = Host Emulation
BaseSpec10	Yes No	No	

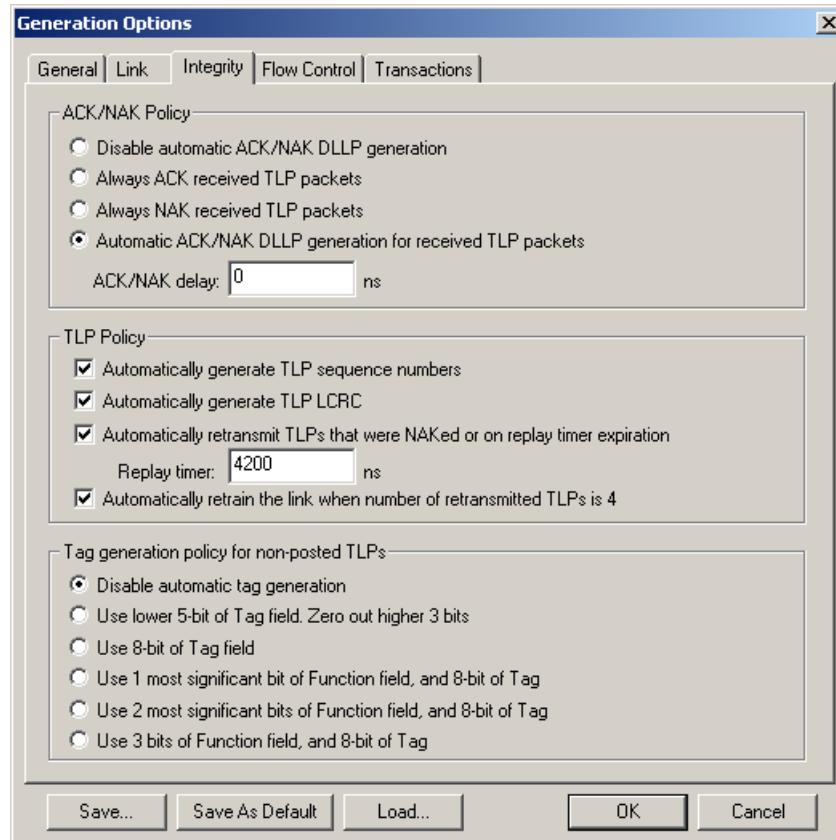
Link



Parameter	Values	Default	Comment
SkipTimer	In ns (rounded to nearest 8) Off.	4720	Periodic timer that controls sending of SKIP ordered sets at specific intervals. Timer's value is measured in 1us units. The SKIP timer should be 4720 ns <-> 6152 ns per the spec.
FTSCount	0 to 255	255	Number of FTS ordered sets required (as sent in TS)
ExtendedSynch	Yes No	Yes	Forces LTSSM to send 4096 Fast Training Sequences when leaving LOs state. The value entered in the text box sets the NUM_FTS field in training patterns TS1, TS2 as generated by LTSSM.

Integrity

The Integrity page sets the parameters for two Config commands: **Config = TLP** and **Config = AckNak**

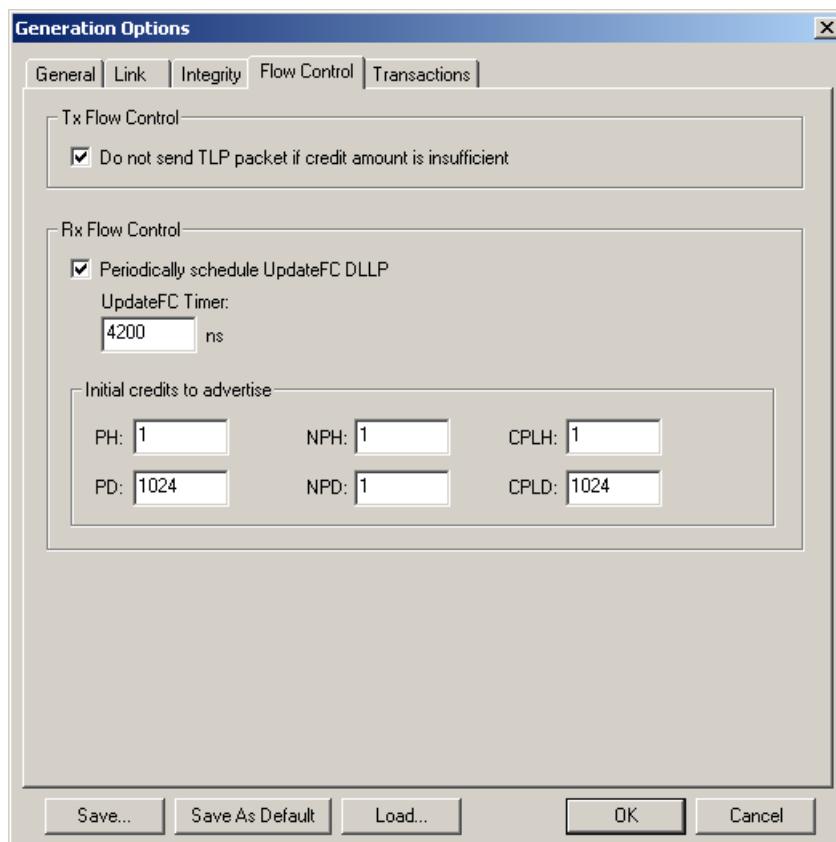


Parameter	Values	Default	Comment
AckNak Policy	Auto Ack Nak Disable	Auto	Auto: Automatic ACK/NAK DLLP generation for received TLP packets (default). Ack: Always ACK received TLP packets Nak: Always NAK received TLP packets Disable: Disable automatic ACK/NAK DLLP generation.
AckNak Policy AckNak Delay	In ns (rounded to nearest 8)	0	Timer that controls how much delay is added to AckNak DLLP response after TLP reception. Valid if AckNak is Auto, Ack, or Nak. Used to delay AckNak, thereby allowing customers to test their replay mechanisms and replay timer.
TLP Policy AutoSeqNumber	Yes No	Yes	If not set, overrides automatic generation of the TLP sequence number and uses user-defined value of the field in the Packet=TLP commands. This option overrides any sequence numbers specified in the script.
TLP Policy AutoGenerate LCRC	Yes No	Yes	If not set, overrides automatic generation of LCRC and uses user-defined value of the field in the Packet=TLP commands. This option overrides any LCRC specified in the script.
TLP Policy ReplayTimer	In ns (rounded to nearest 8) Off	4200	Timeout in TLP transmitter path that counts time since last Ack or Nak DLLP is received. If set, automatically retransmit TLPs that were NAKed or on replay timer expiration.
TLP Policy AutoRetrain	Yes No	Yes	If set, enable automatic retraining of the link in case the number of retransmitted TLP is 4. Valid only when AutoRetransmission is set.

Automatic Tag Generation	Yes No	No	<p>Disable automatic tag generation.</p> <p>Prevents PETrainer from automatically inserting a tag.</p> <p>Tags are a sub-field of the transaction ID field.</p> <p>When auto tag insertion is enabled, the tag field is only modified for non-posted transactions such as CfgRd, CfgWr, and MemRd.</p> <p>Options are:</p> <ul style="list-style-type: none"> Use lower 5-bit of Tag field. Zero out higher 3 bits. Use 8-bit of Tag field. Use 1 most significant bit of Function field and use 8-bit of Tag field. Use 2 most significant bits of Function field and use 8-bit of Tag field. Use 3 bits of Function field and use 8-bit of Tag field.
--------------------------	-----------	----	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

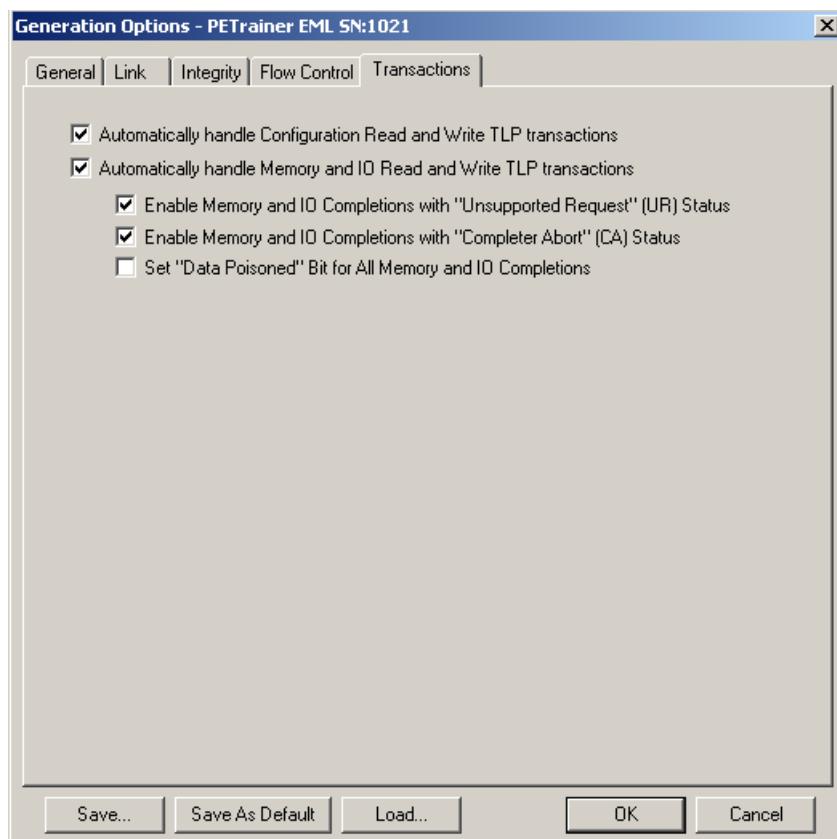
Flow Control

The Flow Control page sets parameters for **Config = FCTx** and **Config = FCRx**.



FCRx Parameter	Values	Default	Comment
Enable Tx Flow Control	Yes No	Yes	When not set, the TLPs are being sent without the regard of how many credits are available. This option prevents TLP transmission if insufficient credits are available.
Enable Rx Flow Control	In ns (rounded to nearest 8) Off	4200	When enabled, allows automatic updating of these DLLPs. This option enables a periodic timer that controls sending of UpdateFC DLLPs. You should leave timer and credit values to defaults for correct behavior.
PH	0 to 255	1	Posted Request Headers
NPH	0 to 255	1	Non-Posted Request Headers
CplH	0 to 255	1	Completion Headers
PD	0 to 4095	1024	Posted Request Data Payload
NPD	0 to 4095	1	Non-Posted Request Data Payload
CplD	0 to 4095	1024	Completion Data Payload

Transactions



Parameter	Values	Default	Comment
Automatically handle Configuration Read and Write TLP transactions	Yes No	No	If set, automatically handles Configuration Read and Write TLP transactions. For Configuration Read transaction, Completion TLP contains the data read from the internal Configuration Space according to specified register address. For Configuration Write transaction, internal Configuration Space is updated at the address with the data taken from Configuration Write TLP, and Configuration Write Completion is returned. This option enables Read and Write access to 4 KB configuration space.
Automatically handle Memory and IO Read and Write TLP transactions	Yes No	No	If set, automatically handles Memory and IO Read and Write TLP transactions. For Memory and IO Read transactions, Completion TLP contains the data read from the internal Memory/IO Address Space according to specified address. For Memory and IO Write transactions, internal Memory/IO Address Space is updated at the address with the data taken from TLP.
Enable Memory and IO Completions with Unsupported Request (UR) Status	Yes No	No	If set, enables Unsupported Request (UR) status for Memory/IO completions. AutoMemIoCompletion must be set to enable UR completions.
Enable Memory and IO Completions with Completer Abort (CA) Status	Yes No	No	If set, enables Completer Abort (CA) status for Memory/IO completions. AutoMemIoCompletion must be set to enable CA completions.
Set Data Poisoned Bit for All Memory and IO Completions	Yes No	No	If set, all Memory/IO completions have Poisoned bit set.

10.6 Generating Traffic: Set Generation Options

Before beginning generation, set options in the Generation Options dialog box:

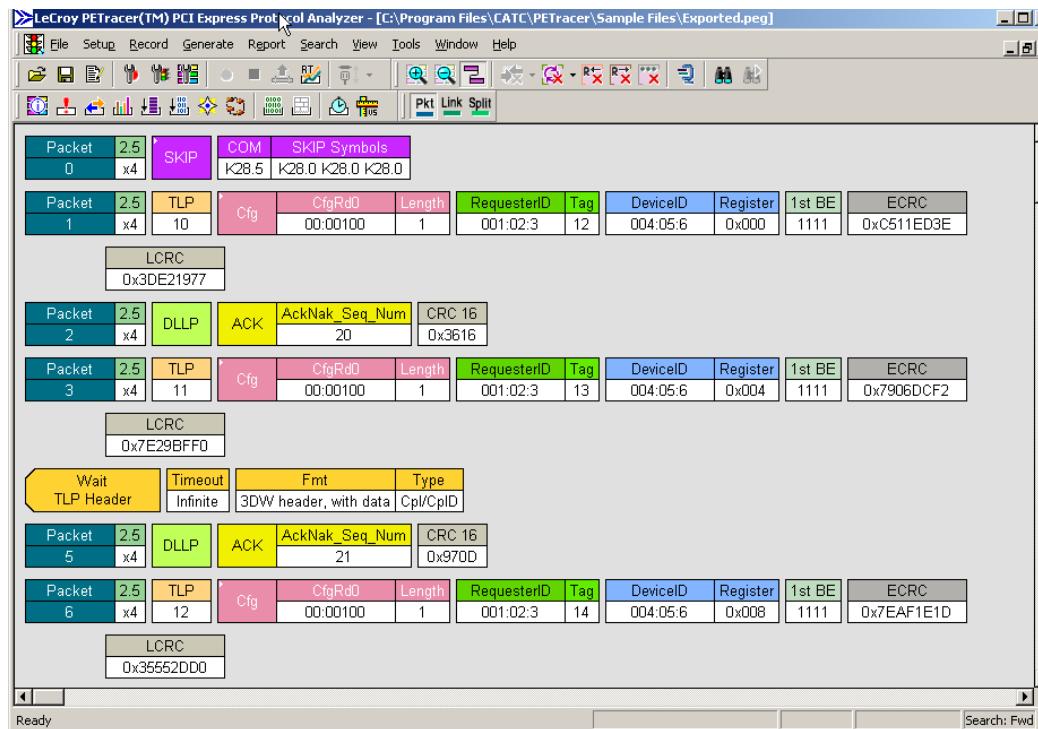
- Step 1** Open the Generation Options dialog box by selecting **Setup > Generation Options** from the menu. The Generation Options dialog opens.
By default the General page displays.
- Step 2** To test 1.0 devices, check the box next to **Base Spec Rev. 1.0 Compatibility Mode** to select 1.0 compatibility mode.
To test 1.0A devices, leave this box unchecked.
- Step 3** Set the generation direction based on type of device you are emulating.
- Step 4** Select one of the two **Interposer** options:
- **Host Emulation:** Select **Host**
 - **Device Emulation:** Select **Device**
- Step 5** Select the **Link** tab. The Link page opens.
- Step 6** Select **Enable Automatic Skip Generation**, but leave the setting at the default value: 4720 ns.
- Step 7** Select the **Integrity** tab. The Integrity page opens.
- Step 8** Check to enable **Automatic ACK/NAK DLLP generation for received TLP packets**.
- Step 9** Enable all four TLP policies and set **ACK/NAK Delay = 0 ns**.
- Step 10** Select the **Flow Control** tab. The Flow Control page opens.
- Step 11** Check the checkbox to enable **Do not send TLP packet if credit amount is insufficient**.
- Step 12** Check the checkbox to enable **Periodically schedule UpdateFC DLLP**.
- Step 13** Use the defaults for all other boxes.
- Step 14** Click **OK** to apply all changes and close the Generation Options dialog.

10.7 Generating Traffic: Prepare Traffic Generation

To prepare for traffic generation, follow these steps:

Step 1 If it is not running, start the PETracer™ software.

Step 2 Open an existing script file or create a new script. For example, open the traffic generation file **Linkup.peg** by selecting **File > Open** from the menu. The following packets display in the main window.



The CATC Trace window shows the type of traffic that is to be generated in the current generation session.

Step 3 If needed, make changes to the script file,

then save the file by clicking the **Save** button .

10.8 Generating Traffic: Begin Traffic Generation

To begin traffic generation:

- Step 1** Start generation by clicking the **Start Traffic Generation**  button on the Status bar.

This action causes the software to download the script to the PE Trainer device. After the download completes, the device starts executing the script.

As the script executes, the Status bar displays the script's progress. The **Current script position** field displays the command description and CATC Trace packet number currently being generated.



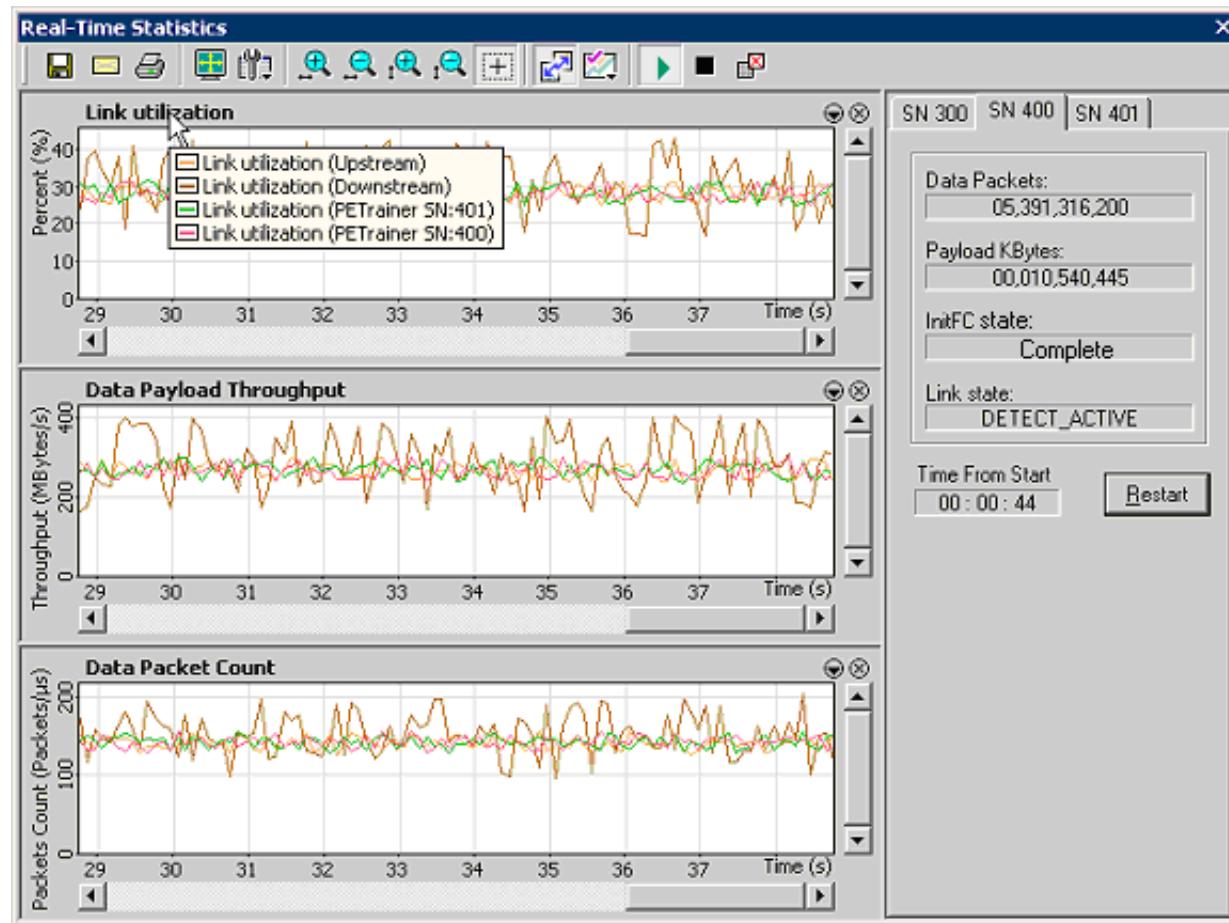
Note: Script execution can be terminated at any time by clicking the

Stop Generation  button on the toolbar.

If a Wait command is executed where the Display parameter is specified, the user-defined text is displayed.

If a **wait=user** script command is executed, the script pauses until you click the **Resume Generation** button  on the toolbar.

Step 2 Open the Real-Time Statistics window by clicking  .



To the right is a **Statistics Accumulation** area. In this area look for two messages:

- **InitFC State:** Complete (shown in the example above)
- **Link State:** LO

If the messages appear, then it means that the Exerciser successfully completed the Link training.

Note: Link training can also be performed by clicking the **Trainer Connect** button on the Status bar.

Chapter 11: Macros

11.1 Macros

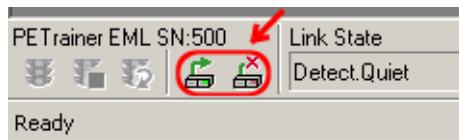
PETrainer™ EML™ allows users to add buttons to the Status bar at the bottom of the window (and add commands to the Generate menu) to run traffic generation macros on the Exerciser.

After a macro script has been defined and assigned to a button the on the Status bar, the macro can be run by clicking the macro button with the mouse or selecting the macro name from the Generate menu.

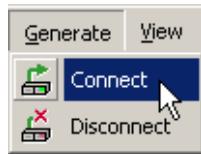
Default Macros: Connect and Disconnect

By default, the PETracer™ software includes two macros, **Connect** and **Disconnect**. These buttons execute macros for creating and breaking a connection between the Exerciser and a DUT.

The buttons are on the Status bar when Exerciser hardware is present.



The commands are also on the Generate menu:



Connect Macro

The default code for this macro is the following:

```
Config = General {TrainerReset = 1}  
Link = Detect  
Wait = 500  
Link = L0  
Wait = 500  
Link = InitFC
```

Disconnect Macro

The default code for this macro is the following:

```
Config = General {TrainerReset = 1}  
Link = Detect
```

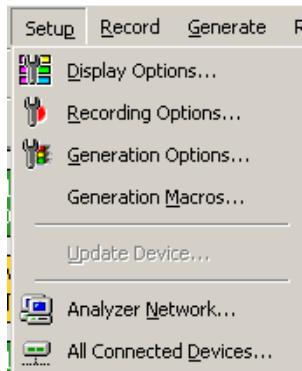
11.2 Adding New Script Macros

There are two ways to add script macros:

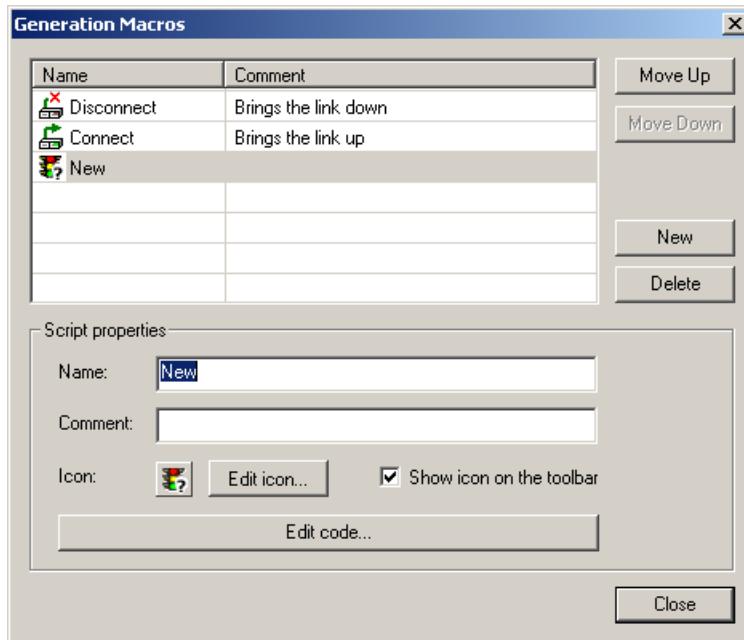
- Using the Generation Macros dialog
- Adding script files to the GenScriptMacros directory.

Using the Generation Macros Dialog

Step 1 Open the Generation Macros dialog by selecting **Setup > Generation Macros** from the menu.

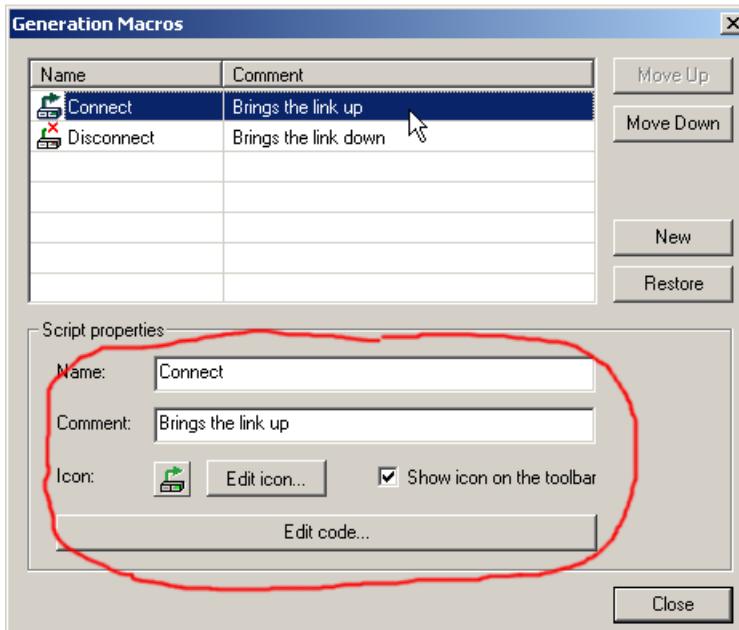


Step 2 In the Generation Macros dialog box, click the **New** button.



Step 3 Within **Script properties** area specify **script name**, **script comment**, **script icon**, and **whether or not to show script icon** on a toolbar.

Step 4 Create a new icon for the script by clicking **Edit Icon...** button. The Edit Generation Macro Icon dialog appears.



Step 5 Using the tools provided, paint the icon for new script macro and then press **OK**.

Step 6 Edit the script code by clicking the **Edit code...** button. The dialog closes and an empty script editing window appears (see Section 10.3, “Editing Generation Files with the Script Editor” on page 192).

Step 7 Type the script code and press the **Save** button. The script macro and icon are saved in the **GenScriptMacros** directory located under the PETracer directory (for example, **Program Files\CATC\PETracer\GenScriptMacros**).

Step 8 Close the script window. The new macro script button automatically appears on the Status bar at the bottom of the window. Clicking this button causes PETracer to execute the script.

Adding Script Files to the GenScriptMacros Directory

The second way to add a new PETracer script macro is to copy an existing PETracer script file in the **GenScriptMacros** directory.

Step 1 Copy a script file into the **GenScriptsMacros** directory located under the PETracer directory (for example, **Program Files\CATC\PETracer\GenScriptMacros**).

Step 2 Switch to the PETracer application. You see that a new icon has been automatically added for the script file to the Status bar at the bottom of the window. The default icon is assigned to the new script macro and the file name is used as a script name.

11.3 Modifying Script Macros

To modify a macro assigned to a button:

Step 1 Select **Setup > Generation Macro** from the menu.

The Generation Macros dialog opens for modifying, creating, and deleting macros:

Name: Name of Macro

Comment: Descriptive comment so you can remember what the macro does

Icon: Currently assigned button for the macro.

Show icon on the toolbar: If checked, places the icon on the Status bar.

Edit Code: Opens a dialog for editing the macro script.

Step 2 Select the macro to be modified.

Step 3 Within the **Script properties** area, modify the **script name**, **script comment**, **script icon**, and whether or not to show script icon

Step 4 To edit script code, press the **Edit code...** button. The Generation Macros dialog closes and the Script Editing window appears, showing current code for the selected script macro.

Note: If the Generation Script Editor pane does not appear, click .

Step 5 Modify the script code and press the **Save** button .

Step 6 Close the script window. The macro has now been modified.

11.4 Changing the Order of Macro Icons on the Status Bar

To change the order of script macro icons on the Status bar:

Step 1 Open Generation Macro Scripts dialog by selecting **Setup > Generation Macros**.

Step 2 Click the **Up** and **Down** buttons to change the order of the script macros.

Step 3 Close the dialog. The button order is changed.

11.5 Deleting User-Defined Script Macros

To delete a script macro:

Step 1 Open the Generation Macro Scripts dialog by selecting **Setup > Generation Macros**.

Step 2 Select the macro you want to delete and press the **Delete** button:

All deleted scripts and icons are removed from **GenScriptMacros** directory. A backup copy is stored in the **GenScriptMacros\Deleted** directory.

Note: You cannot delete the Connect and Disconnect script macros.

11.6 Restoring the Default Appearance of the Connect and Disconnect Icons

You can restore the default appearance of the Connect and Disconnect icons by clicking the **Restore** button.

Step 1 Open the Generation Macro Scripts dialog by selecting **Setup > Generation Macros**.

Step 2 Select the macro you want to restore and press the **Restore** button.

Chapter 12: Address Space

12.1 Address Space Toolbar Buttons and Dialogs

On the PETrainer™ toolbar at the bottom of the application window are two buttons:

- Write Address Space
- Read Address Space



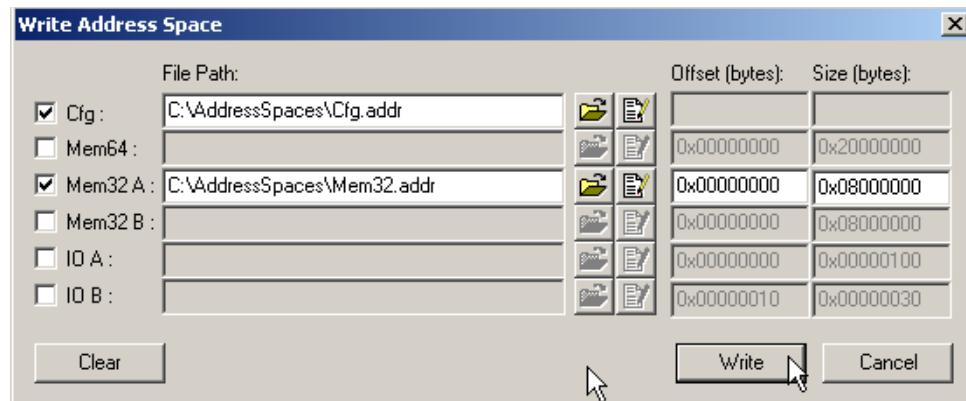
Clicking these buttons opens a dialog for selecting, creating, or editing Address Space settings used by PETrainer. The dialog can also be accessed from the menu: **Generate > Write Address Space** and **Generate > Read Address Space**.

Write Address Space Button

The Write Address Space Button brings up a dialog.

Write Address Space Dialog for PETrainer EML

On the PETrainer EML platform, clicking the **Write Address Space** button opens the following dialog:



The dialog shows a list of address spaces. Check the checkboxes to select Address Spaces.

Note: PETrainer memory regions are assigned to the specific BARs according to configuration space. See “Configuration Space” on page 225.

To select Address Space file(s), click the **Browse** button .

To edit a selected file, click the **Edit** button . This action opens either the Configuration Space Editor or the Memory/IO Address Space Editor depending on which option you have selected.

To specify the offset from the beginning of the PETrainer memory region, enter a value into the **Offset (bytes)** box. The default offset is 0.

To set the size of the data to write, enter a value in the box marked **Size (bytes)**. The default size is the maximum allowed memory size (limited by PETrainer hardware). The **offset+size** should not exceed the maximum allowed memory size (Mem64 = 512 MB, Mem32 = 128 MB, IO = 256 MB).

Note: You cannot specify Offset and Size for Configuration Address Space.

To load all selected memory regions into PETrainer from the selected files, click the **Write** button.

To set all selected memory regions to 0, click the **Clear** button.

Read Address Space Button

This Read Address Space Button brings up one of two dialogs.

PETrainer EML Read Address Space Dialog

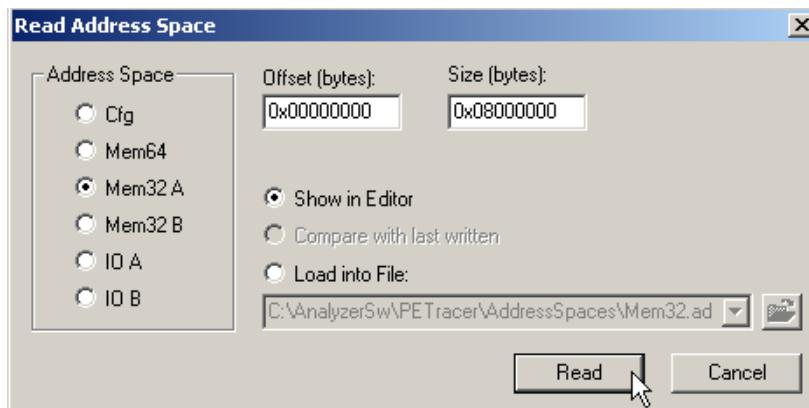
This dialog lets you specify the:

- Address space to be read
- Offset from the beginning of PETrainer memory region
- Size of the data

You cannot specify the Offset and Size for the Configuration Address Space.

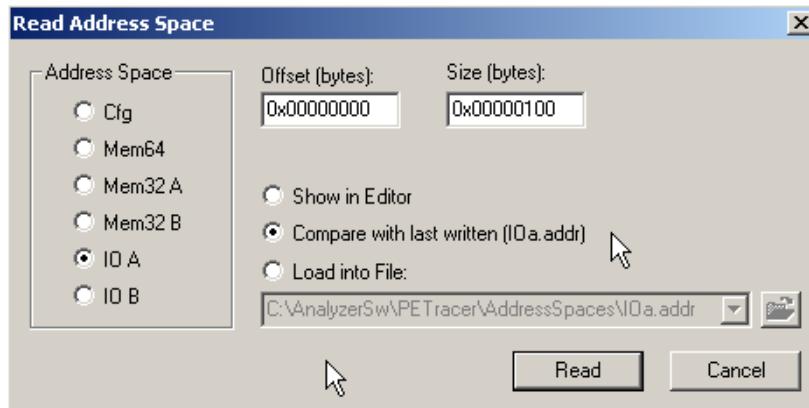
The data read can be processed in three ways:

- Displayed in the Configuration Space Editor or the Address Space Editor. To view the data in these editors, select the **Show in Editor** radio button option.



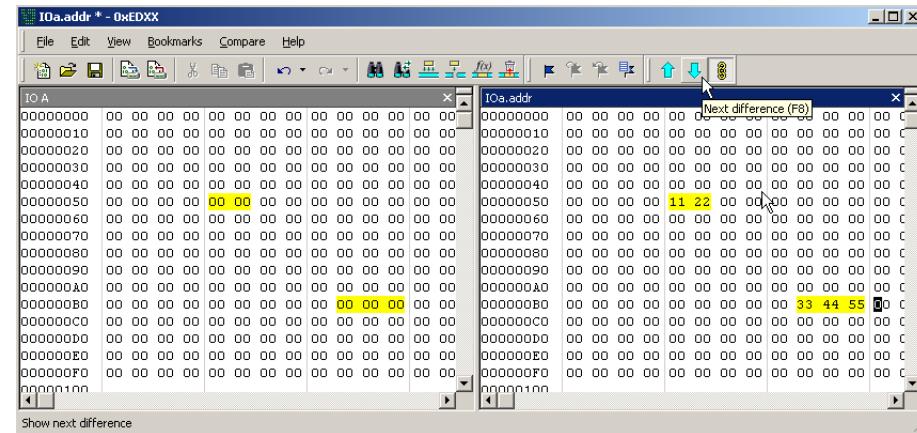
- Stored in a file. To store the data into a file, select the **Load into File** option.
- Compared with previously written file. If you have written memory into the PETrainer hardware as described above (Write Memory Address Space Button), then **Compare with last written** option is enabled.

Note: This option is not available for Configuration Address Space)



In this screenshot Compare with last written option is enabled because the **IO A** memory region was previously loaded from the **IOa.addr** file using Write Address Space functionality.

When you click the **Read** button, the memory is read from the address space, and both memory dumps (**IOa.addr** file and the currently read one) are displayed in the Memory/IO Space Editor:

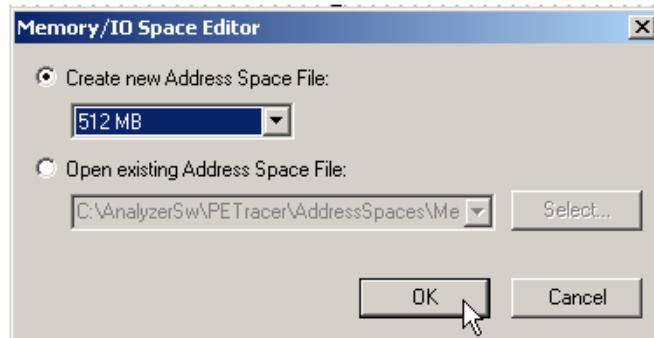


All the differences are marked in **yellow**.

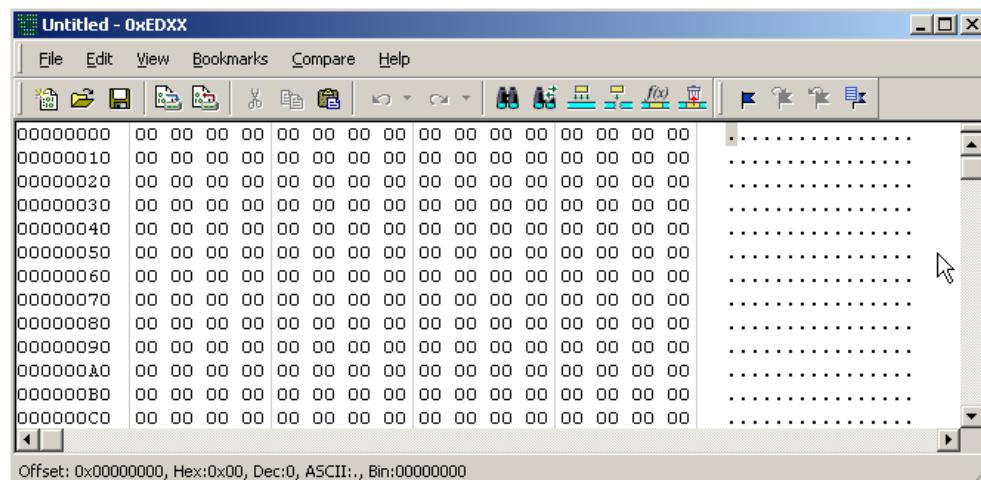
12.2 Memory/IO Space Editor

The Memory/IO Space Editor lets users write address space memory into PETrainer™ and read address space memory from PETrainer.

To access the Memory/IO Space Editor, select **Tools > Memory/IO Space Editor**. The following dialog opens:



- **Create new Address Space File:** Opens the Memory/IO Space Editor and displays an empty address space with the size specified.
- **Open existing Address Space File:** Activates the list of recently used Memory/IO Address Space files and enables the Select... button. After you have selected a file and then clicked Select, the Memory/IO Space Editor opens.



The Memory/IO Address Space editor is implemented as a standard hex editor.

The address space memory must be saved to a file so that it can be downloaded to the PETrainer hardware using PETrainer™ application.

If you prefer, you can write address space memory into PETrainer and read address space memory from PETrainer directly using the

and toolbar buttons or using the menu **File > Write Address Space** or **File > Read Address Space**.

Chapter 13: Configuration Space

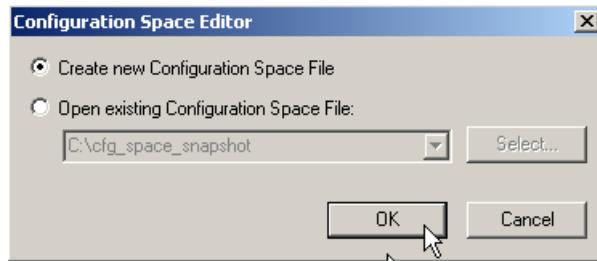
13.1 Configuration Space Editor

The Configuration Space Editor allows the Configuration Space to be modified on a field-by-field basis using hexadecimal or binary format.

The editor supports PCI-compatible Configuration Spaces and PCI Express enhanced Configuration Spaces.

13.2 Launching the Configuration Space Editor

Selecting **Tools > Configuration Space Editor** displays the following dialog:



- **Create new Configuration Space File:** Opens the Configuration Space Editor with the default (empty) configuration space.
- **Open existing Configuration Space File:** Activates the list of recently used configuration space files and enables the **Select...** button. After you select a file and click **OK**, the Configuration Space Editor opens.

Configuration Space Files

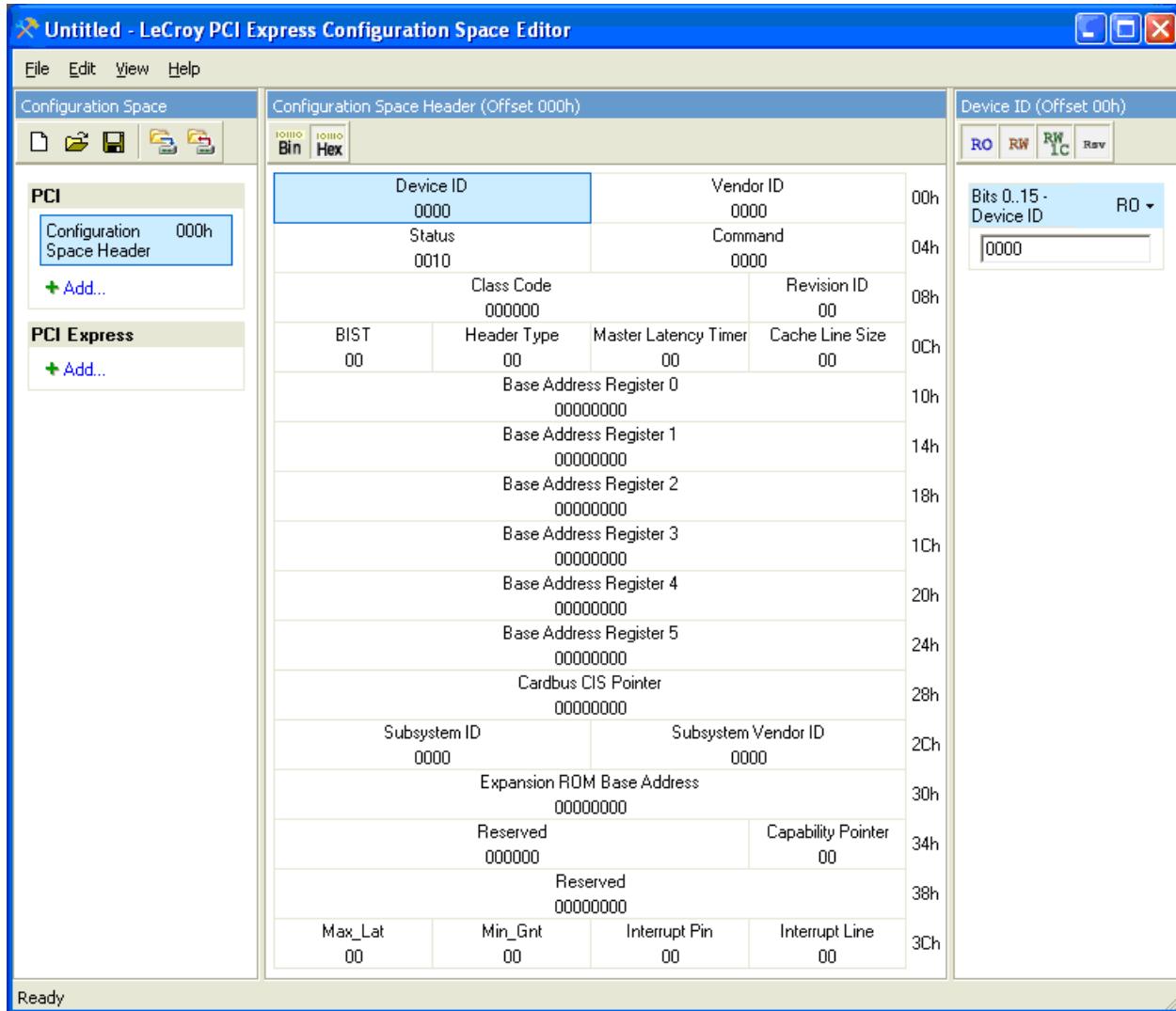
You can save configuration space files in the Configuration Space View (see “Configuration Space View” on page 161). Open a trace file, select a packet, and then select **Reports > Configuration Space View**. Click the **Save** button to display the Save As dialog and enter a file name (which has no special file extension).

You can save configuration space files in the Configuration Space Editor. Click the **Save** button to display the Save As dialog and enter a file name (which has no special file extension).

You can open saved configuration space files in the Configuration Space Editor and optionally edit them. You can then use them for generation.

Editing

When a new file is created, a blank **PCI Configuration Space Header** is loaded for editing. However, its position is not configurable, and the offset always starts at 00h.



In the Configuration Space View, at the left, you can add and define PCI-compatible or PCI Express Configuration-Space Capability Structures.

The toolbar allows you to create a New configuration space, Open a configuration-space file, Save a file, Write Configuration Space, and Read Configuration Space.

Click **+ Add** and then choose a Capability Structure from the context menu. You can also select **Edit > Add PCI Capability** or **Edit > Add PCI Express Capability**.

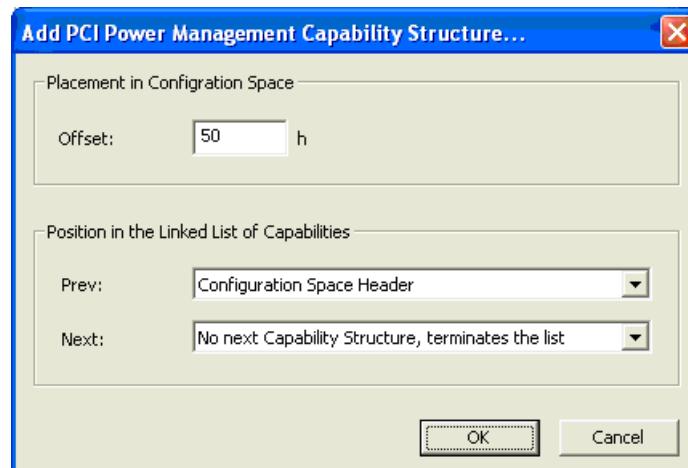
Available PCI Capability Structures are:

- Message Signaled Interrupts
- Accelerated Graphics Port
- Vital Product Data
- Vendor-Specific
- PCI Express
- Hyper Transport
- Generic

Available PCI Express Capability Structures are:

- Virtual Channel
- Virtual Channel for MFVC
- Device Serial Number
- Power Budgeting
- Root Complex Link Declaration
- Root Complex Internal Link Control
- Root Complex Event Collector Endpoint Association
- Vendor-Specific
- RCRB
- ACS
- MFVC
- Resizable Bar
- Multicast
- DPA
- ARI
- LTR
- SR IOV
- Generic

Selecting a structure displays a dialog in which you can define the structure.

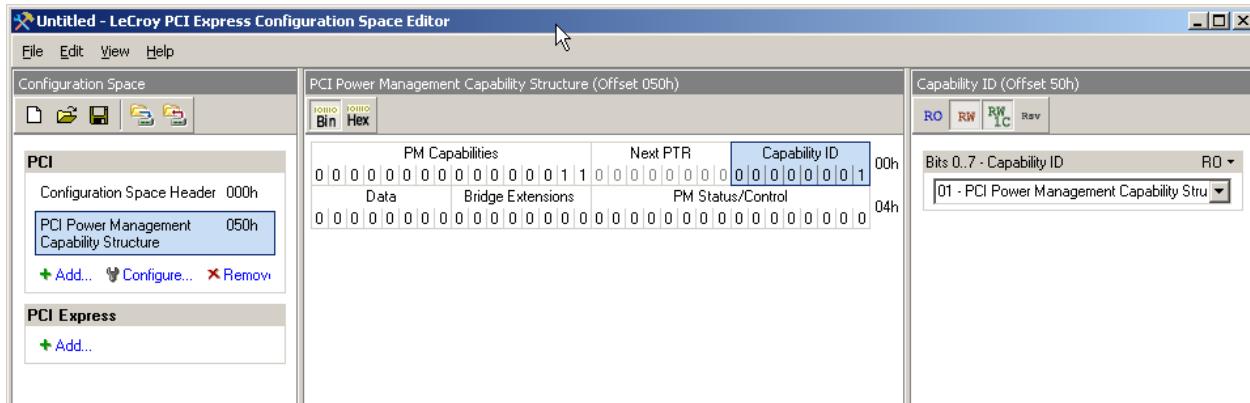


Enter an integer **Offset**.

Position the structure in the linked list of capabilities by selecting the **Previous** and **Next** capability structures.

Note: The Configuration Space View, from the Reports menu, reflects any added structures (see “Configuration Space View” on page 161).

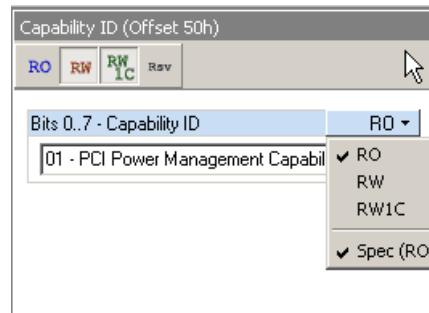
After you click **OK**, the center column displays the Capability Structure View, with the register layout. You can modify the selected Capability Structure by selecting registers and editing in binary or hex. The toolbar allows you to select Binary or Hexadecimal for editing.



Alternatively, after selecting a register, you can modify the register in the Field View in the right column.

The Field View allows you to override field attributes. By default, attributes are assigned according to the specification. The available options are:

- **RO:** Read Only
- **RW:** Read-Write
- **RW1C:** Write-1-to-Clear

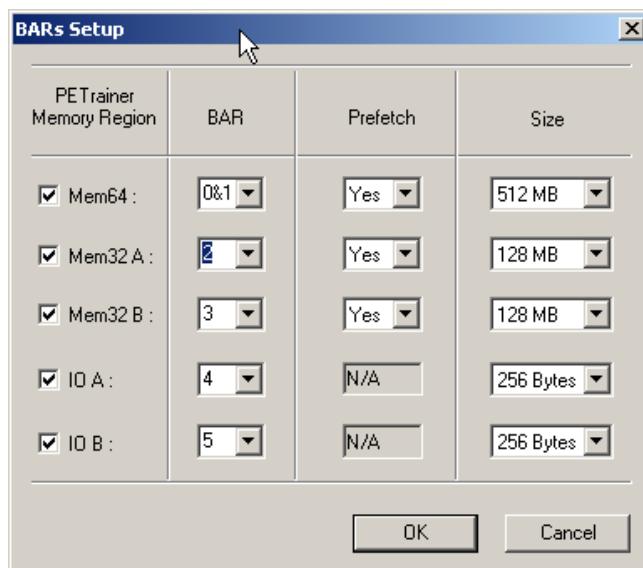


Note: See Appendix A “Configuration Space Decoding” on page 175.

13.3 BARs Setup

The BARs Setup dialog helps set up Base Address Registers. It provides a more convenient way of defining BARs than setting up the BARs manually. In addition, it provides the mapping of BARs to PETrainer and Summit Z2-16 memory regions.

To open the BARs Setup, select **Edit > BARs Setup**.



BAR1 and BAR2 are assigned to 64-bit memory address space and mapped to Mem64 PETrainer memory region. BAR4 is assigned to 32-bit memory address space and mapped to Mem32A PETrainer memory region.

You can specify Prefetch and Address Space Size. The sizes for each address space are limited to the values supported by PETrainer hardware.

BAR and Prefetch fields affect the Hexadecimal/Binary in the middle column of the Configuration Space Editor.

Size field affects Field View in the right column of the Configuration Space Editor.

The mapping of BARs to PETrainer memory regions is discussed at the AddressSpace Command in the Help section of the PETrainer Script Language.

The BAR settings are used for Memory and IO completer.

13.4 Configuration Read and Write

PETrainer™ can automatically handle Configuration Read and Write TLP transactions:

- For a Configuration Read transaction, the Completion TLP contains the data read from the internal Configuration Space according to specified register address.
- For a Configuration Write transaction, the address for the internal Configuration Space is updated with the data taken from Configuration Write TLP, and Configuration Write Completion is returned.

You can specify the initial Configuration Space by editing the **AddressSpace=Write** command directly in the script or by using the UI provided in the Generator toolbar.

The PETracer™ software provides a special editor for editing this file called the Configuration Space Editor (see “Launching the Configuration Space Editor” on page 225).

Chapter 14: Updates and Licensing

14.1 Updating the Analyzer

BusEngine™ and/or Firmware updates are now automatic processes that run anytime a new version of the PETracer™ software is installed that is incompatible with the currently installed BusEngine or Firmware. The update process generates onscreen instructions.

If, however, you need to manually perform BusEngine or Firmware updates, follow these steps:

Step 1 Select **Setup > Update Device ...** from the menu to display the Update Analyzer dialog box for **PETracer EML™**:

Step 2 Select the appropriate file locations for the Firmware and/or BusEngine, using **Browse**, if necessary.

Step 3 Check the appropriate options (if in doubt, check all options).

Step 4 Click **Update** to initiate the updating of the Analyzer.

Updating the Exerciser

To manually update the BusEngine and/or Firmware for PETrainer ML or PETrainer EML, follow the same steps as above.

14.2 License Keys

A License Key is necessary to enable software maintenance. If you attempt to record with the Analyzer without an installed License Key, a message appears to indicate that a License Key is necessary in order to record traffic.

A License Key must be obtained from LeCroy for each Analyzer.

After you obtain the License Key, follow these steps to install it:

Step 1 Select **Help > Update License...** from the menu bar. to display the Update License dialog box.

Step 2 Enter the **path and filename** for the License Key or use the Browse button to navigate to the directory that contains the License Key.

Step 3 Select the **.lic** file, and then click **Update Device**.

You can also update your licensing information by selecting **Setup > All Connected Devices ...**, then clicking **Update License**.

14.3 License Information

You can view Licensing information for your Analyzer by selecting **Help > Display License Information...** from the menu bar. The License Information window displays data about the maintenance expiration and purchased features.

Appendix A: Configuration Space Decoding

The decoded capability structures in the Configuration Space Viewer and Editor are based on programmed definitions in the PETracer software and on Configuration Space Decode Scripts.

Configuration Space Decode Scripts are tools to define capability structures and instruct the Configuration Space Viewer or Editor how to decode them. These scripts are in the **\CfgSpaceScripts** sub-directory below the **\Scripts** directory in the application directory.

You can write Configuration Space Decode Scripts using the CATC Scripting Language (CSL). See the *LeCroy Analyzers File Based Decoding Manual* for reference.

PCI Express Configuration Space Decode Scripts have the file extension **.pecfgdec**.

A.1 Mandatory Definitions

Configuration Space Decode Scripts must set the following reserved variables.

- **CapabilityName**: Name of the capability structure
- **CapabilityID**: ID of the capability structure
- **ExtAddSpace**: Set to 1 if Extended Configuration Space.
Otherwise, set to 0 for PCI.

A.2 Mandatory Module Functions

Modules are collections of functions and data dedicated to decoding a specific capability structure. Each module has one primary Configuration Space Decode Script file (extension **.pecfgdec**) and optionally has include files (**.inc**).

A module function is an entry-point into a decoding module. To help display a capability structure, the application calls a module function.

The Configuration Space Editor and Viewer support only the **DecodeRegister(offset)** and **GetSize()** functions.

DecodeRegister(offset)

The application calls this function while decoding a specific DWORD offset of the specified CapabilityID. The offset is the decoding entry point, where the decoding path starts.

The Configuration Space Editor calls this function to determine how to decode the assigned configuration space. The **offset** parameter is the DWORD to decode.

An offset of 0 indicates bytes 00h-03h, an offset of 1 indicates bytes 04h-07h, and so on.

Note: The Configuration Space Editor can only decode one DWORD at a time.

GetSize()

This function returns the size of the capability structure specified by CapabilityID.

A.3 Configuration Register Types

The following reserved variables are defined global constants.

- CFGREG_UNDEFINED
- CFGREG_HWINIT
- CFGREG_RO
- CFGREG_RW
- CFGREG_RW1C
- CFGREG_ROS
- CFGREG_RWS
- CFGREG_RW1CS
- CFGREG_RSVDP
- CFGREG_RSVDZ

Note: These reserved variables match the Configuration Register Types of Table 7-2 in Section 7.4 of the PCI Express Base Specification, Rev. 2.1.

A.4 Primitives

Decoding uses the following primitives.

GetRegisterField(dword_offset, bit_offset, field_length)

This function returns a register field of length **field_length**, starting at bit position **bit_offset** in DWORD **dword_offset**.

- **dword_offset**: DWORD offset of the register field location
- **bit_offset**: Bit offset of the register field location
- **field_length**: Length of the register field

For example, **GetRegisterField(1, 9, 2)**; means: Go to DWORD 1, bit offset 9, and returns 2 bits.

AddField(field_name, field_length, configuration_reg_type, tooltip, encoding_table = NULL)

This function adds a register field to the Capability View and returns a pointer to the field, for adding subfields.

- **field_name:** Name of the register field to display in the Capability View
- **field_length:** Length of the register field
- **configuration_reg_type:** Configuration register type of the register field.
Note: If subfields are defined, their configuration register types override this setting for their specified bits.
- **tooltip:** Tooltip displayed for the register field in the Capability View
- **encoding_table:** Optional. Displays encodings as lists for select values.
- For example, user input becomes a combo box for the field in the Field View.

As examples:

AddField("PCI Express Extended Capability ID", 16, CFGREG_RO, "");

means: Add the field "PCI Express Extended Capability ID" with length 16 and cfg register type CFGREG_RO.

capability_reg = AddField("Capability Register", 32, CFGREG_RW, "");

means: Added the field "Capability Register" with length 32 and cfg register type CFGREG_RW and stored a pointer to this field in variable capability_reg, which can be used to add subfields to this field.

AddSubField(parent_field, subfield_name, subfield_length, configuration_reg_type, tooltip, encoding_table = NULL);

This function adds a subfield to a register field in the Capability View. Subfields are modifiable and visible in the Field View and appear in the tooltips of register fields.

- **parent_field:** Pointer to a register field in the Capability View
- **subfield_name:** Name of the subfield, displayed in the Field View
- **subfield_length:** Length of the subfield
- **configuration_reg_type:** Configuration register type of the subfield field.
Note: This overrides the configuration_reg_type of the parent field.
- **tooltip:** Tooltip displayed for the subfield in the Capability View
- **encoding_table:** Optional. Displays encodings as lists for select values.
- For example, user input becomes a combo box for the field in the Field View

For example,

AddSubField(capability_reg, "Mode Supported", 4, CFGREG_RO, "Indicates the Function modes,"), ModeEncodings);

means: Add the subfield "Mode Supported" to the parent field "capability_reg" with length 4, type CFGREG_RO, a tooltip in the Capability View, and a combo box displaying "mode encodings" for input in the Field View.

A.5 Helper File

ConfigSpaceCommon.inc include file contains useful functions for script decoding.

Appendix B: China Restriction of Hazardous Substances Table

The following tables are supplied in compliance with China's Restriction of Hazardous Substances (China RoHS) requirements:

部件名称	有毒有害物质和元素					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr ⁶⁺)	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
PCBAs	X	O	X	X	X	X
机械硬件	O	O	X	O	O	O
金属片	O	O	X	O	O	O
塑料部件	O	O	O	O	X	X
电源	X	X	X	O	X	X
电源线	X	O	X	O	X	X
保护外壳(如有)	O	O	O	O	X	X
电缆组件(如有)	X	O	X	O	X	X
风扇(如有)	X	O	X	O	X	X
交流滤波器和熔丝组件(如有)	X	O	X	O	O	O
外部电源(如有)	X	X	X	O	X	X
探头(如有)	X	O	X	O	X	X
O: 表明该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T11363-2006 标准规定的限量要求之下。						
X: 表明该有毒有害物质至少在该部件的某一均质材料中的含量超过 SJ/T11363-2006 标准规定的限量要求。						

EFUP (对环境友好的使用时间) 使用条件: 参阅本手册“规范”部分规定的环境条件。

Part Name	Toxic or Hazardous Substances and Elements					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent Chromium (Cr ⁶⁺)	Polybrominated Biphenyls (PBB)	Polybrominated Diphenyl Ethers (PBDE)
PCBAs	X	O	X	X	X	X
Mechanical Hardware	O	O	X	O	O	O
Sheet Metal	O	O	X	O	O	O
Plastic Parts	O	O	O	O	X	X
Power Supply	X	X	X	O	X	X
Power Cord	X	O	X	O	X	X
Protective Case (if present)	O	O	O	O	X	X
Cable Assemblies (if present)	X	O	X	O	X	X
Fans (if present)	X	O	X	O	X	X
AC Filter/Fuse Assy (if present)	X	O	X	O	O	O
Ext Power Supply (if present)	X	X	X	O	X	X
Probes (if present)	X	O	X	O	X	X
O: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement specified in SJ/T11363-2006.						
X: Indicates that this toxic or hazardous substance contained in at least one of the homogenous materials used for this part is above the limit requirement specified in SJ/T11363-2006.						

EFUP (Environmental Friendly Use Period) Use Conditions: refer to the environmental conditions stated in the specifications section of this Manual.

How to Contact LeCroy

Type of Service	Contact
Call for technical support...	US and Canada: 1 (800) 909-7112 Worldwide: 1 (408) 653-1260
Fax your questions...	Worldwide: 1 (408) 727-6622
Write a letter...	LeCroy Protocol Solutions Group Customer Support 3385 Scott Blvd. Santa Clara, CA 95054-3115 USA
Send e-mail...	psgsupport@teledynelecroy.com
Visit LeCroy's web site...	teledynelecroy.com/

[This page is intentionally blank]

Index

Symbols

+ Packet # button 92
.lic files 232
.opt files 98
.peg files 192
.peg traffic generation files 187
.pem file 65
.pem files 65
.pex files 65, 67
.rec files 65

Numerics

100 ohm series resistor 23
16-lane advanced verification system 3
40-pin Data Input/Output Connector 18
5-volt pin 23

A

AC Connector 19
ACK/NAK Delay 208
Actions Properties dialog box 125
Activity 58
Activity LED 15, 17
Add Analyzer dialog box 32
Add Counter command 129
adding
 PETracer 39
address 239
Address Space settings 219
Address Space Size field 229
Advanced Hiding Options 50
All Connected Devices command 232
Analyzer 7, 13
 license 232
 networked 32
 setting up 29
 update 231
analyzer
 testing 61
Analyzer Network Chat Bar command 70

Analyzer Network command 32
Analyzer Network dialog box 32
Analyzer Setup LED 15
Any Event 132
Any TLP event 131
application 27
Auto-Configure Lane Polarity 108
Automatic ACK/NAK DLLP generation for received
TLP packets 208
automatic generation 185
Available Events area 113
 110
averaging 169

B

Bandwidth 179
BAR field 229
BAR settings 229
Bars Setup dialog box 229
BARs Setup... button 229
Base Spec 1.0 Rev Compatibility Mode 108
Base Spec Rev. 1.0 Compatibility Mode 208
Beep When Trigger Occurs 106
Bitmask 130
blue current-position indicator 156
blue highlight 194
BNC Connectors 18
Both directions 158
Breakout Board 23
brown highlight 194
browsing network 32
Buffer Size 100, 102
Bus Reset button 37
Bus Utilization 140, 179
 buttons 143
 features 169
 metrics 168
 pop-up menu 141
BusEngine update 231

C

Cable Connector 37
Cable Setup LED
 17
calculating time between DWORDs 148
Capability Structure View 228
Capability Structures 227
CATC Technical Support 239
CATC Trace 6
cells 72
 resizing 71
 states 111
Change Counter Value command 128
changing
 markers 78
channeling input signals 25
Channels 124
Chat session 70
Chat window 70
circuits 24
Clear Marker command 78
Clock Select 38
Clocks radio button 82
collapse 194
Collapse Idle 149
Collapse Idle Plus. 149
Collapsible Idle Time 147
collapsing 71
Color Format Hiding tab 91
Color pop-up menu 93
colors 92
Combining Specified Event Groups 86
Combo box 162
Comma Separated Value files 68
Command Properties window 192, 196
Comment 216
Comment field 77
comment string 77
Compare with last written option 221
ComputerID field 162
Completion TLP 230
configuration limitations 115
Configuration Read 230
Configuration Space 161, 225, 230
 editing 226
 Header 226
Configuration Space dialog box 161
Configuration Space Editor 225, 230
 command 225
Configuration Space Header 162

Configuration Space View 161, 162
Configuration Write 230
configuring
 Exerciser 185
 Recording Options 61
conflicts 116
Connect macro 213
 restoring 217
Connect/Disconnect button 61
connecting
 interposer data cable 34
 PETracer EML to devices 35
connectors
 receptacles and cables 21
contact 239
Context menu 194
Continue option 62
Continuous Time Scale 149
Control-b command 84
Control-f command 84
controls
 Analyzer EML 15
 Exerciser EML 16
Count action 114
Count field 129
Counter 124
Counters 128
counters
 setting 129
counting 128
Create new Address Space File 223
Create new Configuration Space File 225
creating
 script 189, 191
CSV files 68
Ctrl+N command 191
Current script position field 210
current-position indicator 156
custom circuits 24

D

Data Cable Connector 37
data cells 71
Data Field 71
Data Flow command 151
Data Flow window 151
Data In/Out connector 23, 24
Data Input/Output Connector 18
Data Throughput 163, 179
data.pem file 63

data.pex file 62, 65
data_pem_files directory 63
dataXYZ.pem files 105
decode levels 79
decoding 79
default options file 109
default settings 61
default.opt file 98
default.rec file 109
delimiters 156
Description String 124
descriptive label 109
Device Emulation 208
Device Emulator 36
 installing 36
device emulator 35
DeviceID field 162
Direction 189
Direction field 86
Disable Descrambling 107
Disconnect macro 213
 restoring 217
Display area 44
Display Configuration Name 91
Display License Information command 232
Display Options 89
 command 89
 dialog box 89
 fFiles 65
 loading 98
 saving 98
Display Options button 89
DLIP Packet Properties dialog 127
Do not export hidden packets 189
Do not export Idle packets 189
Do not save hidden packets option 67
Do not send TLP packet if credit amount is insufficient 208
Downstream 107
Downstream direction 158
Drag an event here to create a new sequence 111
drive strength 25
DUT
 powering on 39
DWORD 130
DWORDs
 timing 148

E

edge connector 36

Edit as Text command 192
Edit Code 216
Edit code... button 215, 216
Edit Comment command 69
Edit Generation Macro Icon dialog box 215
Edit Icon... button 215
Edit Marker command 78
Edit Marker for Packet # pop-up 77
editing
 macros 216
 script 194
electrical idle 185
e-mail 239
Email CATC Support 239
Emulation Test Fixture 37
 installing 38
emulation test fixture 35
Emulator 36
emulator 35
Emulator Power LED 38
Enable Automatic Skip Generation 208
Enable Outlining 198
Enable Tool tips 90
environmental conditions 20
Error Log 192, 197
Error Properties dialog box 125
Error Summary dialog box 137
error types 125
Errors 197
Errors pane 155
event
 counting 128
Event Groups menu 86
Event Icon Preview 124
Event Navigation 139
Event Properties dialog box 124
Event Trigger recording type 102
events
 searching 81
Event-specific Settings 125
Exclude option 86
executing 210
Exerciser 9, 14
 configuring 185
 powering on 39
 setting up 30
expand 194
Expand Data command 71
Export Wait for ACK from upstream 190
Export Wait for Cpl from upstream 190

- exporting 68
 Trace to a Traffic Generation File 189
- Ext option 38
- Ext. In Connector 18
- Ext. Out connector 18
- External Interface Breakout Board 23
- external signals 25
- F**
- fax number 239
- field
 hiding 95
- Field Colors tab 92
- Field Formats tab 94
- Field View 228
- File Export dialog box 189
- file formats 68
- File Information window 136
- File Menu 51
- File Tabs 197
- File tabs 192
- filter 133
- Filter action 114
- Filter In button 133
- Filter Out button 133
- Find command 85
- Find dialog box 85
- Find Next command 87
- finding 85
- Firmware update 231
- First, Prev, Next, and Last buttons 162
- Fit to Graph Area 141, 174
- flow control 186
- Flow Control tab 208
- Flush option 62
- Fonts 90
- format
 field 94
- From 189
- From packet # field 69
- From Packet field 67
- front panel 15, 16
- fuse 19
- G**
- General page 208
- General tab 61, 89, 100
- Generate Menu 53
- Generate menu 213
- generating 185, 210
 theory 185
- Generation Macro command 216
- Generation Macros command 214
- Generation Macros dialog box 214, 216
- Generation Options command 198, 208
- Generation Options dialog box 198, 208
- Generation Status bar 58
- Generator file format 68
- GenScriptMacros directory 215
- Global State 111
- Global State Cell 113
- Go To Marker command 82
- Go to Marker command 148
- Go To menu 83
- Go to Packet # 141
- Go to Packet command 81, 82
- Go to Script Editor 195
- Go to Trigger command 81
- Grid Lines 139
- ground pins 23
- Group and Colors column 92, 94
- H**
- hardware 3, 5
 specifications EML 20
- hardware failure 29
- hardware wizard 29
- header fields 74
- Help Menu 56
- Hexadecimal vs. Binary tabs 162
- Hide 141, 174
- Hide buttons 49, 148
- Hide Downstream button 49
- Hide SKIP and Update FC button 49
- Hide Training button 49
- Hide Upstream button 49
- hiding 95, 96
 Idles 148
- Hiding tab 96
- host controllers 35
- Host Emulation 208
- Host Emulation Test Fixture 37
 installing 38
- host emulation test fixture 35
- Host PC requirements 12
- Host PC software requirements 22
- Host RX Voltage Level 36
- humidity 20

I

Icon 216
 Icon Label 124
 idle 185
 Idle errors 125
 Include files 190
 Include statement 187
 Include statements 197
 information
 priority 157
 InitFC complete status 176
 InitFC State 211
 InitFC State segment 59
 input signals 25
 Install Software command 27
 Int
 option 38
 Int SSC option 38
 Integrity tab 208
 Intellisense 194
 interface 27
 internal rules 116
 Interposer 33
 interposer
 installing 34
 interposer data cable
 connecting 34
 Interposer options 208
 Intersection option 86
 IOa.addr file 221
 IP LAN 31

J

JP1 setting 36
 JP2 setting 36
 JP3 setting 36
 JP6 setting 36
 Jumper settings 36
 jumpers 36

K

Key
 License 232
 keyboard shortcuts 57
 keystrokes 57

L

label 109

LAN 31
 Latency 179
 Latency Time 163
 Latency Time at Split Transaction level 168
 Layout 192
 layout 44
 LeCroy PETracer command 27
 LEDs
 Analyzer EML 15
 Exerciser EML 16
 Legend option 156
 level hiding 96
 Level Hiding tab 96
 levels 79
 license files 232
 License Information window 232
 License Key 232
 licensing information 232
 limits 115
 Linear 141, 174
 Link Connect toolbar button 185
 Link level decode 79
 Link section 61, 107
 Link Settings 101
 Link State 176, 211
 link state messages 59
 Link State segment 59
 Link tab 208
 Link Tracker
 buttons 149
 toolbar 145
 Link Tracker window 145
 docking 147
 markers 148
 reformat 146
 link training 61, 186
 Link Training sequence 185
 Link Transaction
 metrics 167
 Link Transaction Level graphs 170
 Link Transaction Performance 167
 Link Utilization 179
 Link Width 107
 Link Width pane 155
 Linkup.peg file 209
 List values 194
 Load button 98, 109
 Load command 98, 109
 Load into File option 221
 loading 98, 109
 log 197

Logarithmic 141, 174
logic analyzers 23
long format 71
LTSSM Flow Graph 158
LTSSM Flow Graph command 158
LV TTL output and input signals 23

M

macros 213
 changing order 216
 creating 214
 deleting 217
 editing 216
Main Display Area 145
Main display area 110
manual
 trigger switch 20
Manual Trigger
 recording type 102
Manual Trigger push-button 15, 16
markers 77
 deleting 78
 editing 78
 setting 77, 148
Mask (hex) entry 131
Match (hex) entry 131
MB Segments field 63
memory requirements 21, 22
Memory Write event 132
Memory Writes 167
Memory Writes Performance 179
Memory/IO Space Editor 223
Menu bar 44
menus 51
 pop-up 72
metal face plate 36
metrics 163
 Bus Utilization 168
 Link Transaction 167
 Link Transactions 163
 Split Transaction 166
 Split Transactions 163
 trace 164
 Traffic Summary 166
 unit-base averaging 169
Metrics Header 164
Metrics Tooltip 164
Misc 101, 106
motherboards 35
Msb -> Lsb checkboxes 95

Multisegment
 viewing 105
Multisegment recording 63
Multi-Segment Toolbar 47
multi-segmenting 63

N

Name 216
navigating 152
Navigator 152
 displaying 152
 legend 156
 panes 153, 155
 range 153, 154
 ranges 153
 slider 156
 toolbar 153
Navigator Legend dialog box 156
Navigator Panes button 156
Navigator Range button 154
Network Browse list 70
networked Analyzer 32
networking 31
New button 214
New Event button 113
New Events button 124
New PETrainer Script 191
Number of data packets 176
Number of Link Transactions 163
Number of Packets 163

O

Offset (bytes) box 220
Offset dword 130
Offset field 227
Open existing Address Space File 223
Open existing Configuration Space File 225
opening
 program 28
operating temperature 20
options files 109
Options Name 101, 104
Options Name box 109
Ordered Set Properties dialog box 128
Origin field 86
outlining 194
overview 3

P

package contents 20
 Packet # 92
 Packet # field 77
 Packet Data command 160
 Packet Data window 160
 Packet Directionality Cell 75
 Packet errors 125
 Packet Header bar 159
 Packet Header Cell 76
 Packet Header command 159
 Packet Heading Cell 75
 Packet level decode 79
 Packets/second 179
 pane checkbox 156
 Payload 163
 payload pattern match 130
 Payload Properties dialog box 127
 Payload size 176
 Payload tab 130
 PC 27
 PC requirements 12
 PC software requirements 22
 PCI Configuration Space Header 226
 PCI Express
 cards 35
 slot 36
 PCI Express 16-lane verification system 3
 PCIE Slot Power LED 38
 Pending Requests at Split Transaction level 168
 Periodically schedule UpdateFC DLLP 208
 PETracer
 options 100, 103
 setting up 29
 PETracer EML 7, 11, 13
 adding 39
 opening 28
 PETracer ML
 opening 28
 PETracer SN message 58
 PETrainer
 setting up 30
 PETrainer EML 11, 14
 Pin Button 124
 pin-outs 24
 pins 25
 Plug-and-Play instructions 29
 plus symbol 92, 94
 pop-up menus 72
 Position Trace view on packet x 195

power
 requirements 20
 switch 20
 Power indicator LED 15, 16
 power on/off switch 19
 Power Select switch 38
 power socket 19
 powering on 34, 39
 Pre/Post Trigger pane 155
 Prefetch field 229
 Presence detect signals 36
 Preserve TC to VC mapping across the channels 106
 Print command 69
 Printer button 69
 printing 69
 Probe Data Cable 33
 Probe Data Connector 15
 probing characteristics 21
 product
 overview 3
program
 opening 28
 progress 186
 Properties 142, 174
 Properties button 124
 Properties command 113
 Properties dialog 124
 Properties dialog box 113, 123
 protocol unit 163
 prototype rework area 24
 PRSNT2# setting 36

R

range delimiters 156
 Raw 10b Codes 73
 Read Address Space button 219
 Read Address Space dialog box 221
 Read button 222
 Read Requests Performance 166
 reading 71
 Ready message 58
 Real-Time Statistical Monitor window 174
 Real-Time Statistics
 buttons 172
 pop-up menu 174
 toolbar 172
 Real-Time Statistics window 171, 211
 Real-time Statistics window 175
 rear panel 18

Receive port 37
Receive Probe Data Connector 17
Recently Used Ranges 154
Record button 62
Record Menu 52
recorded activity 60
recording 61, 99
 memory size 21
 multi-segment 63
 stopping 62
Recording button 114
Recording Options
 command 99
 configuring 61
 dialog box 99
 files 65
 loading 109
 saving 109
 settings 109
Recording Options command 61
recording progress 60
Recording Progress Bar 58
Recording Rules
 buttons 112
 examples 116
 limits 115
 logic 116
 toolbar 112
Recording Rules tab 110
recording status 60
Recording Type 100, 102
Refclk 36
Reference Clk connector 38
remote operation 31
Remove 141
Report Menu 53
Report menu 135
reporting 22
reports 135
Reset button 37
Reset Column Widths 147
resizing 71
Response Time 163, 179
Response Time and Latency Time at Split Transaction level 168
Response Time at Link Transaction level 168
Response Time at Split Transaction level 168
restoring
 icons 217
Resume Generation button 210
Right click cell context menu 90
Row Selection 139
RS-232 40-pin Data Input/Output Connector 18
rules
 internal 116
Run verification scripts command 180

S

Save all included files 190
Save As command 67
Save As Default 98, 109
Save As Default. 109
Save As MultiSegment Trace 101, 105
Save as Multisegment trace 63
Save button 98
Save External Interface Signals 106
Save packet range command 67
saving 67, 98, 109
 script 190
script 210
 creating 189, 191
 editing 194
 executing 186
 macros 213, 214
 running 209
 saving 190
script comment 214
Script Edit Window 194
Script Edit window 192
Script Editor 188, 192
 toolbar 193
 tooltips 194
Script Editor button 192
Script Editor toolbar 192
script icon 214
script name 214
Script properties area 214, 216
scripts 185
 memory size 22
Search 58
 command 81
Search Bwd message 84
search direction 60
Search Direction command 84
Search For menu 85
Search Fwd message 84
Search Menu 54
searching 81
Seconds radio button 82
segmenting 63

- segments
 viewing 105
segments.col file 64
Select command 32
self-diagnostic testing 29
Send command 70
Sequence Cell 113
Sequence State 111
servicemarks ii
Set Display Options command 92
Set Marker command 77, 148
Set Range Near Packet xxx 154
Set Range to Whole Trace 154
setting markers 77
Settings button 181
Settings window 181
Setup Menu 52
SFP Sync In Connector 18
SFP Sync Out Connector 18
short format 71
shortcuts 57
Show Configuration Space for xxxx 162
Show Header Fields command 74
Show Header Fields dialog box 74
Show icon on the toolbar 216
Show in Editor radio button 221
Show Line Numbers 198
Show Number of Transitions checkbox 158
Show Raw 10b Codes command 73
Show Tooltips 198
signal descriptions 24
Signal Level switch 37
Size (bytes) 220
Size field 229
Slot 1 Status 15, 16
Slot 2 Status 15, 16
Slot Interposer 33
slot reducer 36
small triangle 71
Snapshot recording type 102
software 43
 installation 27
 update 231
specifications
 EML 20
Specify Action command 114
Split level decode 79
Split Transaction
 metrics 166
Split Transaction Level graphs 169
Split Transaction Performance 166, 179
Spread Spectrum 36
StandardSettings.rec file 104
Start generation button 186
Start menu 27
Start Traffic Generation button 210
statistics 22
Statistics Accumulation area 175, 211
status
 LEDs 21
Status Bar 58
 macros 213
Status bar 44, 186
Status segment 58
Stop button 62
Stop Generation button 210
Stop option 62
stopping recording 62
storage temperature 20
support 239
switches 20
Sync In Connector 18
Sync Out Connector 18
Synchronize Trace View 149
System Status indicator LED 15, 16
- T**
- Target Analyzer 100, 103
Technical Support 239
telephone number 239
temperature range 20
Test Fixture 37
test fixture 35
testing 61, 185
text files 68
theory 185
Throughput 179
Throughput at Link Transaction level 168
Throughput Per Transaction at Split Transaction level 168
Tight Columns 139
time between DWORDs 148
Time Coverage 179
Time Stamp 90
time value 148
time-based averaging 169
Timestamp at the beginning 90
Timing and Bus Usage Calculator 178
Timing Calculations command 178
Timing Calculator dialog box 178
Title bar 44

TLP Header Properties dialog box 126
TLP Prefix Properties dialog box 126
TLP transactions 230
TLP type 130
To 189
To Analyzer connector 17
To Exerciser Receive 37
To Exerciser Transmit 37
to Generator File Format 189
To packet # field 69
To Packet field 67
Toggle Outlining 198
Tool tip Display 147
Toolbar 45, 110
 44
Tools Menu 56
Tools menu 135
Tooltips 57
trace
 cells 72
 exporting 68
 files 65
 metrics 164
 saving 67
Trace Filename & Path 101
Trace Filename and Path 103
Trace Viewer 28
Trace Viewing Level 90
traces
 searching 81
trademarks ii
traffic 71
 analyzing 135
 generating 185, 210
traffic generation
 macros 213
traffic generation files 189, 192
traffic generation prep 209
Traffic Generation Toolbar 48
Traffic Speed pane 155
Traffic Summary
 buttons 139
 metrics 166
Traffic Summary window 138
 moving to packets 138
Traffic Type pane 155
Trainer links 59
Transmit port 37
Transmit Probe Data Connector 17
triangle 71

trigger
 basic events 21
Trigger action 114
Trigger Position 100, 103
Trigger push-button 15, 16
Triggered LED 15, 16
triggers
 count 128
TTL output and input signals 23

U

Undo Zoom 141, 174
Union option 86
unit 163
unit-based averaging 169
Universal Protocol Analyzer System 12
UPAS 12
 powering on 34
UPAS 100K 12
upas100k.sys driver 27
Update Analyzer dialog 231
Update command 231
Update Device command 231, 232
Update License command 232
Update License dialog box 232
updates 231
Upload Size 101
Uploading 58
Uploading data message 60
Upstream 107
Upstream direction 158
USB Cable 33
USB drivers 27
USB Type B Host Computer Connector 18
Use External Reference Clock 107
User input 186

V

Verification Script dialog box 180
verification system 3
View Data Block command 72, 73
View Menu 55
View Options 149, 193
View Options button 147, 198
View Settings 143
Viewer 28

W

Wait commands 186
wait conditions 22
Warnings 197
web site 239
Website, CATC 239
whether or not to show script icon 214
Window Menu 56
Windows hardware wizard 29
Wrap 90
Write Address Space button 219
Write Address Space dialog box 220
Write button 220
Write Requests Performance 166
Writes Response Time 170
Writes Throughput 170

X

x16 Slot Interposer 33

Y

Y Scale Type 141, 174
yellow differences 222
yellow range delimiters 156

Z

zoom 146
Zoom Level 90
Zoom to Trace View 141

